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ABSTRACT

The effectiveness of World Wide Web-based flexible learning practices in Australia was examined. Online vocational education and training (VET) offerings were reviewed, and two Web-based VET modules were examined in case studies that involved observations and semi-structured interviews with teachers and students. According to the survey, approximately 120 modules were offered in a Web-based flexible mode in Australia in 1998. Together, the modules served about 2,300 students, with a median of 31 students involved in each module. The findings suggested that Web-based programs have the potential to support and enhance lifelong learning with an emphasis on learner-directed learning and adaptability. It was concluded that designers of Web-based programs should take advantage of the capabilities offered by technology in ensuring that content materials encourage rich "conversational" interactions and that student self-directedness and reflection are encouraged. The research led to development of data collection and data analysis tools for evaluating Web-based flexible learning in VET. The study findings' implications for the following areas of VET research and practice were discussed: "conversations" in Web-based flexible learning; delivery; the knowledge economy; course design; evaluation; and further research. (Twenty-one tables/figures are appended. The bibliography lists 39 references. The survey questionnaires and a project brochure are appended.) (MN)

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Evaluation of web-based flexible learning

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Executive summary

Context and overview

With both teachers and students having increased access to the web from home and from the workplace, there is a trend to extend technology-based learning. Furthermore, the web is seen as a means of efficiently delivering education and training when and where it is needed, and communicating with large numbers of students who may be separated from each other and from the learning centre by time or distance. It also enables learners to access information at times and places of their choice. This suggests that the new web-based technologies offer good prospects for implementing flexible delivery options. Not only do web-based learning solutions offer effective responses to requirements for efficient information transfer, they also offer powerful alternatives for obtaining effective learning outcomes.

Coinciding with the implementation of flexible delivery methodologies has been the onset of the information technology revolution and the development of digital communications technologies, such as email and the world wide web (www). In the context of educational services, web-based communications technology is not only seen as offering a supplement for traditional delivery methodologies, but also as being capable of revolutionising distance teaching and bringing on- and off-campus teaching modes closer into alignment.

Anecdotal evidence appears to suggest that web-based approaches to flexible learning have been taken up enthusiastically within the Australian vocational education and training (VET) system. Nevertheless, little of a factual nature is known about the variety or effectiveness of these new practices, particularly from a student and learning point of view.

In this report the focus is on the nature of the uptake of web-based technologies and the quality of teaching and learning emerging, since, while digital technologies can offer access to an enormous volume of information, this does not in itself translate into learning; nor does it ensure the development of expertise required for workplaces in a state of change.

Scope and objectives of report

This report provides an overview of selected online VET delivery sites in the Australian scene and, in addition, proposes a model for evaluating web-based flexible learning practices and illustrates the application of the model in two case study sites.

The broad goal of this report is to build a knowledge base in order to ensure that web-based technologies translate into effective learning practices. In addressing this

challenge, the focus will be specifically on evaluation issues arising from web-based technology uptake. In achieving this, the objectives of the report are to:

- survey and describe online VET sites in a national context
- evaluate web-based flexible learning practices at selected VET sites using new purpose-built evaluation tools

Information obtained from surveys and evaluations of learning practices facilitates the development of concepts and tools useful for further evaluations of web-based learning.

In summary, the report consists of:

- a theoretical framework for web-based flexible learning evaluations derived from a 'conversational' framework for teaching obtained from research on what constitutes good teaching and learning practice
- arising from the theoretical framework, a profile of teaching/learning exchanges critical to quality learning outcomes that occur in web-based modules
- arising from these profiles and data obtained from the study of VET practices, information relevant to:
  - the improvement of web-based teaching processes and outputs
  - meeting VET quality assurance requirements relating to web-based pedagogy
  - the need for further research and refinement of evaluative tools and web-based course offerings

Outcomes of this study provide important information for shaping future policy directions and guiding program and delivery choices in flexible learning, especially those involving the world wide web.

Research methodology

This project is descriptive and analytical in nature and has hence adopted quantitative and qualitative methodologies. A theoretical framework, conceptualised in terms of 'conversational' exchanges in the context of web-based flexible learning, underpins the data collection and analysis of the study. Data were gathered through survey and case study methods.

The theoretical framework underpinning the evaluation was developed from Laurillard's 'conversational' theory (1993, 1997) in which the main types of reciprocal exchanges are idea to idea, action to action and idea to action. This research facilitates the mapping of those exchanges for particular modules, clusters of modules and courses.

Good practice in web-based learning settings will be driven by teachers and/or designers paying attention to effective use of 'conversations'. As in traditional classrooms, good practice is more than just stringing together a variety of 'conversations' per se. It is important that practitioners understand that, like the teaching strategies adopted in traditional classrooms, 'conversations' need to be

appropriate and linked to the learning outcomes they are seeking to achieve. The framework developed for this research can assist in promoting a set of coherent 'conversations'. Moreover, the general nature of this framework ensures that it is applicable in a wide variety of learning contexts in vocational education.

Because of the grounded-theory approach also adopted in this research, the 'conversational' framework was also enhanced by the incorporation of relevant context variables. This revision is referred to as a descriptive framework but the 'conversational' framework is embedded within it. This enhanced framework was used for the case studies and is the basis of the tools associated with the gathering and analysis of interview data.

Key findings

Web-based technology uptake in 1998

- There was a high level of interest in the evaluation of web-based flexible learning amongst providers and teachers.
- The number of modules in the survey was surprisingly small because many advertised modules did not yet have enrolments, and because almost half of providers (8 out of 20) were reluctant to disclose detailed information for commercial reasons.
- At the time the survey was undertaken there were 74 modules from 12 providers eligible for inclusion in the survey. These were predominantly from TAFE (public provider) but also included private providers. By projecting from these figures and the number of refusals to participate in the study, it can be estimated that approximately 120 modules were offered in a web-based flexible learning mode in 1998. The median number of students in the modules surveyed was 31, with a range of 6–150. These modules involved a total of about 2300 students.

Module characteristics

- The modules surveyed varied widely and covered a wide range of subject domains, including many technical areas and spanning a broad range of skills. A considerable number of modules dealt with less tangible areas such as the development of teamwork and interpersonal relationships.
- For most modules the nominal duration was 40 hours or less (median=40) as is typical of VET provision. However, two 'modules' were reported to be of over 200 hours in duration.

Evaluation of web-based learning tools

- The development and trialling of an evaluative methodology for gauging online learning in VET is indeed timely, as outcomes from this project can have a direct impact on future web-based modules on offer.

- The 'conversational' framework and its enhancements offer an effective process for the evaluation of web-based flexible learning. The tools developed provide an efficient means of data-gathering and analysis, leading, for example, to 'snapshots' which map learning activity.
- Teacher-centred approaches are dominant in current offerings despite the great potential of web-based flexible learning to engage learners in problem-solving, responding to change and improvement through self-monitoring and self-reflection.

Future directions for web-based learning environments

- The nature and frequency of interactions promoted through web-based programs have the potential to support and enhance lifelong learning with an emphasis on learner-directed learning and adaptability.
- Instructional designers of web-based programs need to take advantage of the capabilities offered by technology in ensuring that content materials encourage rich 'conversational' interactions and that student self-directedness and reflection are encouraged.

Tools to aid evaluation of web-based courses

This research has led to the development of tools for the evaluation of web-based flexible learning in VET. The tools are of two types, those that assist in the gathering of data for evaluations and those that assist in the analysis and display of results.

Email surveys facilitate an efficient means of gathering quantitative data about teaching–learning, which can then be analysed through cluster analysis and displayed using the snapshot graphing tools.

In addition, the interview and data coding tools facilitate a more detailed analysis of qualitative data. The tools indicated are helpful in displaying the range and quality of learning activity and therefore assist in making judgements about the appropriateness of instructional design and teaching methods.

Research implications

As a result of this study, various implications for VET research, context and practice have been identified. These are as follows:

- 'conversations' in web-based flexible learning

  From this research, it is clear that there is great interest and potential in web-based flexible learning for the VET sector. While the internet is central to this teaching–learning mode, it should be noted that complementary offline activities are also important for good practice. What is needed for good learning is a wide range of deep 'conversational' exchanges which involve authentic practice and rich discussions among teachers and groups.

- implications for delivery

  This research covered a wide range of modules and encompassed an extremely diverse range of topics, illustrating that web-based flexible learning can make use of 'conversational' exchanges both on- and offline in the pursuit of learning outcomes. Being extremely flexible, the conversational model allows many forms of interactions—there are no best 'conversational' methods. Certain methods and combinations of methods are better than others at achieving different learning outcomes. Designers and teachers can establish the best combinations through monitoring and evaluation of practice. What is important is that good teaching in web-based flexible learning will involve engaging learners in rich 'conversations'.

- implications for the knowledge economy

  Web-based flexible learning can support the kinds of learning needed for the knowledge economy of the information society, such as lifelong learning, learner-directed learning, learning to learn, contextualised learning, customised learning, transformative learning, collaborative/co-operative learning and just-in-time learning. The evaluative tools provided in this research can help practitioners explore and expand the kinds of flexible learning 'conversations' to extend the breadth of experiences for adult learners.

- implications for course design

  The 'conversational' nature of teaching and learning provides a useful way for course designers and teachers to conceptualise their practice. Such 'conversations' should be thought of as including exchanges other than just face-to-face, and so are inclusive of all types of interactions inherent in resource-based and web-based learning. For learners to achieve expertise, learning must be deep, conceptual and reflective, with strong links between concepts and practice. Teachers need to fashion learning experiences and 'conversations', or combinations of 'conversations', which lead learners to expertise. This is similar to the ways in which teachers align their teaching strategies to the learning tasks at hand.

- implications for evaluation

  In attempting to determine the effectiveness of alternative web-based flexible learning systems, there is a need to categorise and compare groups of users as well as to describe characteristics of interactions of individuals within the same system. The analytic tools provided in this report assist this task.

- implications for further research

  An understanding of how web-based flexible learning can be developed effectively is far from complete. As the development of web-based flexible learning systems continues, it is important to develop appropriate evaluation tools. Such tools need to take account of how to document and analyse learner interactions with such systems. The tools must also take account of the fact that non-linearity and associativity can be represented in numerous ways, and accommodate the importance of both the knowledge representation and interface issues.

Context and overview

Introduction and context

In the light of its stated capacity to satisfy increased demand for cost-effective training, and its potential for customisation (Flexible Delivery Working Party 1993), recent government initiatives have encouraged flexible delivery. According to the Australian National Training Authority (ANTA) (ANTA 1999), 'flexible delivery' provides a range of approaches to training that employers and learners want. An ideal learning context provides learning opportunities when required, at a convenient location, and using a variety of approaches and resources. In other words, there is flexibility of choice in learning for employees and employers.

Flexible delivery options can be viewed in terms of the choices learners are offered in terms of 'what', 'when', 'where', 'how' and 'why' questions, as detailed in table 1. The table also indicates forms of flexibility encountered in this study.

Table 1: Flexible delivery options

	Flexibility/choice/limits	Examples from modules in survey
What	What range of content choices can students make? Can they choose amongst alternatives? Can they construct their own topic or project? Can they apply knowledge gained to their own area of interest/ expertise? Can they determine the depth or breadth of coverage and within what limits?	Materials are available online, supplemented by printed text. Students may also use competencies from modules other than the one they are currently studying. Students may communicate online, asking and answering questions relevant to them.
When	Can students select entry and exit times or speed of progression? Are there scheduled events, if so, are they mandatory and how frequent? Are there opportunities for shortened or concentrated study? Is there 24-hour unlimited access to resources? Are group events offered asynchronously?	Students have an overall semester timetable but study at any time during the day or week, at work or at home. They can work online or offline. Assessments are due at certain times but students are free to submit items outside scheduled times.
Where	How much can students study in the library or at home or work? Can group meetings be held off-campus? Do students need to travel to access resources or to study?	There are no geographical restrictions. Anyone with access to the internet can enrol and study in this class. The class is open for six months and is entirely based on a web browser.
How	Are students able to choose how they study to suit their learning needs? Is a range of alternative resources available in a variety of media?	Students negotiate how to meet course requirements. They use interactive forms that suit their educational levels and experiences. New technology is introduced progressively as they gain confidence.
Why	Is the range of choices available to students helping meet educational (rather than just convenience) needs? Do the range of choices facilitate self-directed, reflective and life long learning?	The range of choices meshes with students' many work, family and other commitments. Adult learning principles underlie the design of all subjects and supporting services.

This report will provide an overview of selected online vocational education and training (VET) delivery sites in the Australian scene and, in addition, explore a model for evaluating web-based flexible learning practices and illustrate application of the model in two case-study sites.

Web in education

The Australian Bureau of Statistics (1998, 1999) reports that 4.3% of Australian households had web and email access in 1996, compared with nearly 16% in 1998. By 1999 the percentage was 22%. With increasing access to the web by teachers and students both at home and the workplace, there is a trend to extend technology-based learning. Further, the web is seen as a means of efficiently:

- delivering education and training when and where it is needed
- communicating with large numbers of students who may be separated from each other and from the learning centre by time or distance
- accessing information at times and places of the learner's choice

These facts suggest that new web-based technologies offer good prospects for implementing flexible delivery options as outlined in table 1. Not only do web-based learning solutions offer effective responses to requirements for efficient information transfer, they also suggest powerful alternatives for obtaining effective learning outcomes (Tinkler, Lepani & Mitchell 1996).

Coinciding with the implementation of flexible delivery methods has been the onset of the information technology revolution and the evolution of digital communications technologies, such as email and the internet (world wide web). Web-based communications technology is not only seen to supplement traditional delivery methodologies, it is seen as being capable of revolutionising 'distance teaching' and bringing on- and off-campus teaching modes closer into alignment (Tinkler, Lepani & Mitchell 1996). All education and training from compulsory through to post-compulsory and higher education sectors are potentially involved in the uptake of these technologies and share stakeholder interests in understanding the educational consequences of the implementation of web-based learning.

Questions of immediate concern to education sectors relating to the uptake of web-based methods encompass costs and other resource implications, including the levels of staff skill, accessibility for students and staff and the quality of teaching and learning. Issues concerning costs, resourcing and access, however, are beyond the scope of this report.

Web in VET

In this report the focus will be on the nature of the uptake and the quality of teaching and learning which is emerging. While digital technologies can afford access to an enormous volume of information, this does not in itself translate into learning; nor does it ensure the development of expertise required for workplaces in a state of change. New curriculum theories and tools for evaluation are called for to address this

challenge. Such concepts and tools will integrate theories of learning, new understandings of the knowledge targets for learning, new approaches to promoting teaching and assessment and new techniques for evaluating web-based learning experiences. This report focusses on these needs in its attempts to explore and analyse a new model custom-built for evaluating web-based flexible learning.

Further, much anecdotal evidence exists that web-based approaches to flexible learning have been taken up enthusiastically within the Australian VET system. Nevertheless, little of a factual nature is known about the variety or effectiveness of these new practices, particularly from a student and learning point of view (Beven 1994, 1995, 1997; Kearns 1997). Indeed, little is known about the effectiveness of web-based provision not only in VET, but in a range of learning situations (Moursund 1995). Vargo (1997) also reports that, while there is much discussion in the literature about using technology and about effective learning, research combining effective learning and web-based delivery technologies is scant.

Scope and objectives of report

The broad goal of this report is to build knowledge in order to ensure that web-based technologies translate into effective learning practices within the VET sector. In addressing this challenge, the focus will be specifically on evaluation issues arising from web-based technology uptake. In achieving this, the objectives of the report will be to:

- survey and describe online VET sites in a national context
- evaluate web-based flexible learning practices at selected VET sites using new purpose-built evaluation tools

Information obtained from surveys and evaluations of learning practices will facilitate the development of concepts and tools useful for further evaluations of web-based learning.

In summary, the report, will consist of:

- a theoretical framework for web-based flexible learning evaluations derived from a 'conversational' framework for teaching obtained from research on what constitutes good teaching and learning practice
- arising from the theoretical framework, a profile of teaching–learning exchanges critical to quality learning outcomes that occur in web-based modules
- arising from these profiles and data obtained from the study of VET practices, information relevant to:
  - the improvement of web-based teaching processes and outputs
  - meeting VET quality assurance requirements relating to web-based pedagogy
  - the need for further research and refinement of evaluative tools and web-based course offerings

Outcomes of this study will provide important information for shaping future policy directions and guiding program and delivery choices in flexible learning, especially those involving the world wide web.

New learning and new teaching in adult and vocational education and training

In order to provide an appropriate learning theory context for the report, this section will briefly identify key new developments in thinking about learning practices. In the following section a taxonomy of learning modes provided by Tinkler, Lepani and Mitchell (1996) will be presented. The impact of digital communication technologies on the provision of learning alternatives is discussed in the subsequent section.

New learning concepts for the knowledge economy

Rapid development and uptake of electronic communication and information technology is a driving force in the emergence of what authors and commentators have termed the 'knowledge economy'. In this 'new economy', the post-industrial developments of the previous generation now extend beyond mere preference for service sector activities: they embrace massive efficiency gains generated by the digital revolution and translate into an economy driven by imperatives of knowledge production and processing.

'Knowledge workers' now need to be active lifelong learners in order to understand and embrace technological developments and respond to the human resource needs of a rapidly changing economy. Knowledge workers are expected to create new knowledge by accessing information from broad sources. Workers must develop 'executive' knowledge management skills. They need to select the kinds of knowledge relevant to work, make choices about how this knowledge can and should be generated, and implement strategies to contextualise general knowledge for more specific ends. Digital technologies play a critical role in operationalising every facet of knowledge production.

Mirroring changes in workplace requirements, new concepts for learning have also evolved. Underscoring these, arguably, has been the constructivist view of learning and knowledge development in which learning is not characteristised as information transfer. Rather, knowledge growth is a learner-directed process of developing, extending, modifying and re-organising existing knowledge in order to generate purpose-built knowledge structures. New learning concepts include:

- lifelong learning
- learner-directed learning
- learning to learn
- contextualised learning
- customised learning
- transformative learning

- collaborative/co-operative learning
- just-in-time learning (Tinkler, Lepani & Mitchell 1996, p.79)

A brief outline of these ideas and their developing relationship to web-based learning and other concepts follows.

Lifelong learning

For some time, a key role of educational institutions has been to prepare an individual for a lifetime profession or trade. In recent times, this role has changed to become one of facilitating lifelong learning. The need for lifelong leaning is driven by rapid changes in technology and work practices. A widespread response by institutions to such needs is to allow flexibility in entry points to courses and to create new pathways for cross-sectoral articulation. Furthermore, there is an increase in the diversity of courses to suit the needs of diverse learners. Those studying alongside traditional school leavers are retirees, workers who need to re-train due to changes in workplace structures and technologies, and those undergoing a total career change.

The National Board of Employment Education and Training (1994) identifies a lifelong learner as one who has:

- an enquiring mind
- helicopter vision
- information literacy
- a sense of personal agency
- a repertoire of learning skills

These characteristics continue to inform the learner support mechanisms of educational institutions, including those engaged in web-based flexible learning.

Learner-directed learning and learning to learn

The approach to adult education has shifted from teacher to learner. Indeed, a key principle of adult learning is to facilitate self-directed learning. In doing so, the teacher plays a support role as a resource, a facilitator and as a challenger, rather than as a director of learning. However, adults need to acquire the skills and dispositions for self-directed learning in order to become successful lifelong learners. Self-directed learning skills can be learned and are an essential part of lifelong learning. Learning to learn gives more control over the direction and pace of one's own learning. Learner-directed learning encourages teamwork such as that needed for systems operations in the workplace. As Tinkler, Lepani and Mitchell (1996) explain:

> *It provides students with the time and opportunity to develop deep conceptual understanding through a variety of learning experiences where they are actively engaged in the learning process, researching, adapting and problem solving with their peers.*
>
> (Tinkler, Lepani & Mitchell 1996, p.85)

To facilitate such learning using technology, Laurillard (1993) proposed a modification of course design focussing on 'instruction' to one that focusses on 'learning'.

Contextualised and customised learning

There is much diversity in the characteristics of learners in VET. VET reforms driven by competency-based training (CBT), have created a significant shift from mastery of knowledge to contextualised and experiential learning and skilling for the workplace (Billett et al. 1999). The integration of theory and practice that can be offered through CBT is attractive to employers. School-based VET and increased apprenticeship and traineeship opportunities further enhance relevant learning experiences for many learners seeking vocationally relevant outcomes. Educational institutions and workplaces accommodate such needs through customised learning packages. Web-based learning offers further opportunities for flexible delivery when and where required.

Transformative learning

Another area of learning that has gained significance in the 'new world' is transformative learning. Tinkler, Lepani and Mitchell (1996, p.89) explain the concept as:

> *Fundamental to knowledge productivity through innovation is the ability to challenge existing paradigms in response to new knowledge and new environmental circumstances, as well as the ability to make continual incremental changes within a dominant paradigm, whether of a knowledge discipline, an institutional framework, or an organisational design of work processes.*
> (Tinkler, Lepani & Mitchell 1996, p.89)

Essential for transformative learning is:

- understanding given information
- learning about learning that includes strategies for analysis
- learning the content to challenge and refine meaning

The communicative capabilities of web-based learning can provide rich opportunities, not just for acquiring new ways of working and thinking, but also collaboration, challenge and reflection with others engaged in the same process.

Collaborative/co-operative learning

Holistic systems of planning and organisation have gradually replaced linear production systems in many workplaces. This change has encouraged more collaborative and co-operative work practices and learning. Workers are often now required to be multiskilled and operate at the systems level instead of carrying out tasks that are repetitive and serve a single purpose. To be effective, they need to conceptualise their tasks as part of the holistic operation of their workplace. To operate successfully in a holistic manner they have to collaborate and co-operate with fellow workers from various areas of their workplace. Web-based technologies, and educational technologies in particular, can enhance collaborative and co-operative learning and work beyond a single faculty to multiple disciplines in a global village.

Just-in-time learning

Knowledge economy workers need a capacity to access information from diverse sources and modify, extend and develop current skills and understandings in response to demand. Mirroring this, educational institutions need to supply learning opportunities which meet emerging needs. In addition, both students and teachers, via the medium of digital information technology, have the need to utilise resources where and when needed.

New learning technologies for flexibility

Distance education, supported by paper-based resources, used to be the most common form of flexible delivery. In paper-based delivery, flexibility addresses the questions of 'where' and to some extent the question of 'when' learning takes place. Learning can occur at a chosen location, often at chosen times of the day or week (for example, after work). The biggest revolution in distance education in recent times has been the increased use of networked information and communication technologies that broaden the scope of flexibility offered for teaching and learning, not only in addressing 'when' and 'where' questions of flexibility but also questions of 'what', 'how' and 'why'. Indeed, such educational technologies now set the agenda for flexible delivery and flexible learning. Web-based technologies are perceived by many to support effective pedagogy that includes acquisition of knowledge and development of skills and attitudes for lifelong learning (Vargo 1997). These technologies support effective learning methods such as:

> *Delivery of accurate facts, interactive learning, deep learning, ability to apply knowledge, development of judgement, lifelong learning attitudes, joy of learning, group learning, two way communication feedback, learning in context, problem and case based learning and control over content and pace.* (Vargo 1997, p.10)

In summary, technological innovations are currently creating new possibilities for both teachers and learners. They have the potential for adding innovative and creative ways of delivery and learning that could benefit a wider population of non-traditional clients in the post-secondary sector.

Evaluating flexible learning methods

This section deals with critical issues surrounding the evaluation of teaching and learning practices in VET. The first section outlines broad alternative approaches to evaluation and the subsequent sections sketch the 'conversation'-inspired alternative which is advanced in this report.

Evaluating web-based flexible learning: The alternatives

Holistic conceptual frameworks for educational evaluation have been developed over many years (for example, Eisner 1977; Scriven 1967; Stake 1976; Stufflebeam & Webster 1980). These frameworks are designed for use with traditional forms of educational delivery and require large resources over considerable periods of time to

implement. Other, less comprehensive and less expensive evaluation frameworks have also been devised. For example, Alessi and Trollip (1991) advocate three basic methods of evaluating the design qualities of any course:

- review of subject matter by experts and instructional designers to assess the content, appearance, and evidence of good instructional practices
- feedback from students involved in a pilot offer of the course
- validation of the instructional effectiveness by students in a mainstream (normal) class (Alessi & Trollip 1991, p.365)

The first of Alessi and Trollip's (1991) methods can also be referred to as a quality review process consisting of seven parts:

- language and grammar
- surface features of the displays
- questions and menus
- other issues of pedagogy
- invisible functions of the lesson
- subject matter
- offline materials

Alessi and Trollip (1991) have designed a quality review checklist to guide such evaluations. The checklist itemises different features of the lessons that need deliberate decisions. Considerations relating to 'language and grammar' include features such as reading level, cultural bias, technical terms and jargon spelling, grammar and punctuation and spacing. Displays, presentation modes, text quality, input, notes to indicate the end of the lesson form aspects relating to 'surface features'. The section on 'questions and menus' include menus, questions, how to answer questions, format of feedback, and quality feedback. 'Issues of pedagogy' relates to considerations about learner types, facilitation methods, types of resources, student control, motivation, interactions, and animation and graphics. Records and data, security and accessibility, too much data and restarting are classed as ' invisible functions of the lesson'. The 'subject matter' features concentrate on goals and objectives, information, content emphasis and organisation. 'Offline materials' relates to printed manuals, general advice about the operation of learning systems, lesson content, auxiliary materials and other resources.

The second method of evaluation, pilot testing, according to Alessi and Trollip (1991) is a seven-step process:

- selecting helpers (for example, students)
- explaining the procedures to them
- determining their prior knowledge
- observing them during the learning sessions
- interviewing them afterwards
- assessing their learning
- revising the lesson

The third of the processes advocated by Alessi and Trollip involves validation of the lessons to check instructional effectiveness. This is done by delivering the course in a natural instructional setting. Summative evaluation procedures for a thorough treatment are recommended for this stage of evaluation. Two key areas that need to be assessed are students' achievements—to ensure that they have learnt what was intended—and assessment of attitudes towards the course. The Alessi and Trollip approach, however, does not make explicit any underlying view of what constitutes good teaching and learning practice, leaving the basis of the evaluation hidden from scrutiny.

Other authors have also advocated approaches where the views of teaching and learning remain undeclared. For example, Eisenberg and Johnson (1996) provide a checklist, named the 'big six skills approach to information problem solving', that lists major skills important for a range of learning tasks. The skills are task definition, information-seeking strategies, location and access, use of information, synthesis and evaluation. According to Eisenberg and Johnson, these skills are required for learning using computers and hence have relevance for web-based learners. No doubt these skills are important for carrying out a range of learning tasks. However, they are eclectic criteria not based on a coherent body of research as to what constitutes good teaching and learning practice.

While all of these frameworks offer educational evaluation of traditional teaching and learning systems, they are nor appropriate in the web-based context. To help ensure efficient and effective web-based flexible learning, a different approach with a strong underlying framework for good practice is needed. Comprehensive frameworks which are sensitive to flexible and technology-based learning and which can be applied quickly and efficiently are most desirable.

Good teaching practices

A point emerging from the above is that any evaluation framework for learning–teaching practices must be linked to assumptions about the nature of good teaching and learning. On this topic, of course, there has been a great deal of important research. For example, a recent Organisation for Economic Co-operation and Development report (Renwick 1996) lists a set of eight summary working principles associated with high-quality teaching:

- well-devised courses are essential to effective learning
- good practice encourages student/teacher practice
- good practice encourages active learning
- good practice encourages co-operation among students
- good practice gives prompt feedback
- good practice emphasises time on task
- good practice communicates high expectations
- good practice respects diverse talents and ways of learning

While there is no one 'best' teaching method, some methods and combinations of methods are better than others at realising the sort of constructive engagement with learning activities that lead to changes in understanding (Ramsden 1992). Generally, however, an important distinction is made between teacher-centred and learning-centred instruction, as set out in the following section.

Teacher-centred instruction

In teacher-centred approaches to web-based learning, the dominance of the instructor and the instructions is obvious by the way learners are directed to specified activities, from preset menus, often with a limited choice of alternatives. The publication of printed self-paced modules onto the web with little change represents the extreme of such an approach, but does provide student options mainly in time and place of learning. However, such materials are severely limited in exploiting the potential of the technology for learning and flexibility in terms of what is learned and how it is learned. Nevertheless, many implementations with more interaction also conform to this teacher-directed approach. Student choice is often in the form of take-or-leave-it options or alternative pathways which rapidly reconverge towards predetermined ends. There are few open-ended possibilities and the only problems faced are those with neat solutions already known by the designers of the instruction.

Student-directed learning

By contrast, student-directed learning is centred on projects and problems for which detailed solutions are ill-defined and perhaps unknown to the teachers. Problems of design and composition and those involving the construction of new procedures and techniques to overcome new challenges fall into this category, as do questions requiring new causal explanations. With its rich network of linkages to knowledge and techniques, the web provides ideal opportunities for the construction of solutions to such problems. However, since the solutions are not known by the teachers at the time of course design, the direction of learning must be handed over to the learners, with teachers acting as guides and facilitators to research available resources. Other students and people other than teachers can also provide valuable resources, including those of devil's advocate and challenger.

In this context, exchanges which provide discussion and sharing of information and techniques are valuable and can be facilitated on the web through email, bulletin boards and chat facilities. 'Frequently asked questions' and corresponding responses can be posted to provide self-directed guidance for students. Group tutorials via the web can aid communication with teachers and fellow students, and are particularly valuable for clarifying complex concepts and for brain-storming possible solutions.

A 'conversational' approach to teaching and a framework for evaluation

The theoretical framework for evaluating web-based learning utilised in this report steers a mid-course between teacher-centred and student-directed learning approaches to teaching and learning as outlined above. The so-called 'conversational' framework adopted derives from the view that good teaching and learning is reflected in deep

exchanges between all participants in the learning event and is consistent with activity-based views of learning.

For example, Stevenson (1994, 1995) drawing on cognitive perspectives for learning, argues that, in order for learners to achieve expertise, learning needs to be deep, conceptual and reflective, with strong links between concepts and practice. For Stevenson, good learning outcomes—conceptualised as the achievement of expertise in a domain area—are signalled by self-monitoring/regulating activities and generative and adaptive behaviours and are associated with understanding embedded in practice. While 'expertise' itself is defined as:

> *The ability not only to perform routine technical skills, but also to: generate skilled performance as technical tasks become complex and as situations and processes change; reason and solve technical problems; be strategic; innovate; and adapt.* (Stevenson 1994, p.9)

Similarly, Ramsden (1992) reasons that teachers should encourage deep approaches to learning by promoting reflective activity and dialogue:

> *In short, a teacher faced with a series of classes with a large group of students should plan to do things that encourage deep approaches to learning; these things imply dialogue, structured goals, and activity Teaching is a sort of conversation.* (Ramsden 1992, p.98)

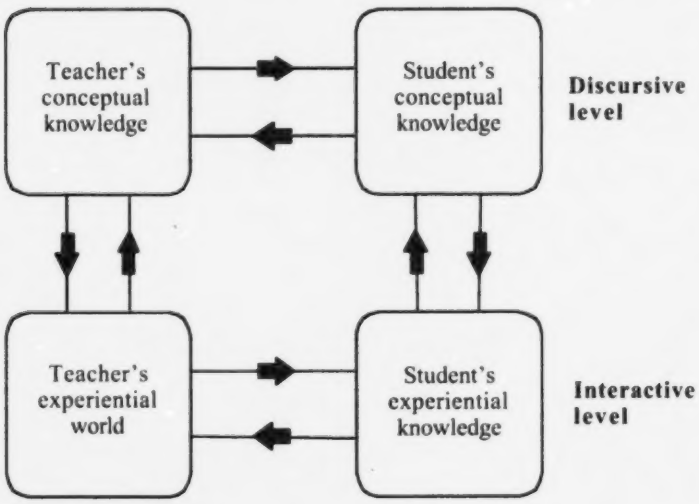
These authors illustrate that learning can be viewed as involving a rich set of inter- and infra-psychological interactions among students, teachers, and the teaching contexts, entirely the perception of the 'conversational' approach to learning proposed by Laurillard and others. Drawing on Pask (1976, 1984, 1988) and Ramsden (1992), Laurillard (1993) argues that the social interactions of the learning environment ('conversations') are reminiscent of a Socratic dialogue involving leading exchanges between student and teacher. Indeed, Laurillard sees the one-to-one tutorial as an ideal, if inefficient, teaching situation. For good dialogue, exchanges need to occur at both the 'discursive' level (about ideas) and the 'interactive' or experiential level (about action) and be between teachers and students (see figure 1).

Building on these ideas, Laurillard (1993) provides a framework which is specifically directed to the evaluation of educational technology (for example, audio-visual media, hypermedia, interactive media, adaptive media and discursive media) and which explicitly states a view of good teaching in which rich 'conversational' exchanges are valued, as happens in successful tutorials (and corresponding laboratory and practice situations). This analysis is based on her 'conversational' framework underlying good teaching. The framework facilitates an evaluation of characteristics of media against a comprehensive set of twelve teaching/ learning activities. A modification of Laurillard's analysis is shown in table 2. In this view only those media (or combinations of media) which support all twelve interaction types provide a good teaching and learning environment.

In her analysis, Laurillard (1997) alludes to the strengths and limitations of each type of medium. Her analysis suggests that careful selection, integration and incorporation of multiple media (as opposed to multimedia) can lead to effective design qualities for

better coverage of learning processes. Such advice is in line with current practices described in the case studies of this research where providers use a combination of modes and media to support web-based learning.

Figure 1: A 'conversational' framework for the learning process



Source: Laurillard (1999)

McKavanagh (1997) argues that one of the virtues of Laurillard's 'conversational' view of teaching and learning is that it can be applied more widely than just to traditional learning environments and demonstrates how the framework can be applied to workplace and adult learning. To maintain quality learning outcomes, forms of these 'conversations' need to be present in web-based flexible learning. It needs to be emphasised that the 'conversational' exchanges involve not only ideas, but also actions and transformations between ideas and actions. Such 'conversations' have significance within VET where learners are acquiring technical expertise in which practice ought to be embedded in understanding if that practice is to be adaptable (Stevenson 1994).

In Laurillard's framework, the interchanges between teacher and student may occur at several levels as feedback from one person stimulates another to respond. Laurillard (1993) argues that all of these exchanges, including at least a two-level cycle between teacher and student, are needed for effective learning. When this entire framework is utilised, learning is deep, reflective, conceptual and practical. As noted above, this is what Stevenson also regards as being necessary for the development of technical expertise.

Table 2: Summary of media characteristics for 12 teaching–learning activities derived from the 'conversational' framework of Laurillard

Type of media	Teacher variables						Student variables						Number of types of interaction
	A	B	C	D	E	F	G	H	I	J	K	L	
Tutorial simulation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
Tutoring system	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12
Audio-vision	Y			Y	Y		Y	Y	Y	Y	Y	Y	9
Tutorial program	Y	Y	Y	Y		Y	Y	Y	Y		Y		9
Computer supported collaborative work				Y	Y		Y		Y	Y	Y	Y	7
Microworld				Y	Y		Y		Y	Y	Y	Y	7
Modelling				Y	Y		Y		Y	Y	Y	Y	7
Multi-media resources	Y				Y		Y	Y	Y	Y		Y	7
Self-assessed questions				Y			Y	Y	Y		Y	Y	6
Computer conferencing	Y	Y					Y	Y					4
Simulation				Y	Y				Y	Y			4
Video	Y			Y	Y							Y	4
Audio-conferencing	Y	Y					Y						3
Hypertext	Y						Y	Y					3
Television	Y			Y	Y								3
Video conferencing	Y	Y					Y						3
Print	Y												1

Note: Key to table 2—Codes for types of learning interaction for each teaching–learning activity

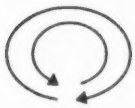
Code	*Type of learning interaction*
A	Teacher can describe conception
B	Teacher can redescribe in light of student's conception
C	Teacher can adapt task goal in light of student's description or action
D	Teacher can set task goal
E	Teacher can set up world to give intrinsic feedback on actions
F	Teacher can reflect on student's action to modify redescription
G	Student can describe conception
H	Student can redescribe in teacher's redescription or student's action
I	Student can act to achieve task goal
J	Student can modify action in light of intrinsic feedback on action
K	Student can adapt actions in light of teacher's description or student's redescription
L	Student can reflect on interaction to modify description

Source: Derived from the conversational framework of Laurillard (1997, p.177)

The framework can be extended to mentoring and peer tutoring (common in adult learning settings) where there may be frequent switches between who is learning and who is teaching. The generalised and simplified framework as used in this study is

shown in figure 2, where the exchanges within the learning system are indicated, regardless of whether these are within or between individuals and who is designated as teacher learner.

Figure 2: Generalised 'conversational' framework with explanations emphasising exchanges within and between individuals

Framework	Explanation
 idea	One individual explains a concept. A listener tells back their own understanding of the concept and goes on to compare this concept with other known concepts. Similarly requirements for study and assessment may be discussed.
action	A concept is used as the basis for formulating an action. The results of an action cause a concept to be revised.
	An action is modeled by one person and another attempts to copy it. The copy is imperfect so, with variations to emphasise selected aspects, the model is redisplayed and recopied.

'Conversational' evaluation framework

Laurillard (1993) maintains that, effective teaching and learning involves rich 'conversations'. According to Laurillard (1993), 'conversations' include not only verbal exchanges, but also other kinds of interactions, such as demonstrating and copying and 'conversations with self' (Vygotsky 1962) that involve self-reflection and monitoring of one's own activities, such as are required for self-improvement. In other words, both teacher and student must be responsive and reactive to the ideas and practices of others as well as to themselves. If media are used for teaching and learning, then these media must facilitate these 'conversational' exchanges. In analysing a wide range of media, Laurillard concludes that very few media can bridge all exchanges. In fact, the only media which come close to reflecting on and adapting to the needs of learners are very sophisticated, specialised and expensive intelligent tutoring systems. Laurillard's analysis of media was completed before widespread access to the internet was available. However, the generalised 'conversational' framework derived from her work can be used to provide a check on the comprehensiveness of technological innovations in catering for all exchanges regarded as essential for deep, effective learning in vocational and academic domains. This is in contrast to many media and print-based courses in which critical aspects of teaching and learning are omitted. Thus, the framework selected here has the potential to provide the basis for analysis of broad learning systems, particularly in relation to how well they facilitate reflective processes for staff and students.

In utilising the 'conversational' framework for evaluating flexible learning in web-based learning environments, this research provides both an evaluation of these

implementations and an appraisal of the framework itself. The evaluation framework derived from 'conversational' theory holds a significant position for the evaluation of web-based learning materials. Laurillard's framework has been enhanced to incorporate adult learning principles in line with VET practice and is applied to current web-based learning implementations (McKavanagh 1997). Laurillard's framework has been generalised and simplified as shown in figure 2, where the forms of the exchanges within the learning system are indicated, regardless of whether these exchanges are within or between individuals. The enhanced framework provides a broad encompassing structure for a wide range of teaching–learning interactions from which efficient evaluative tools have been derived.

Thus, the framework selected here has the potential to provide the basis for analysis of broad learning systems, particularly in relation to how well they facilitate reflective processes and the relationships between theory and practice. In appraising such a teaching–learning model, however, context variables also need to be considered and the research methods adopted here keep open the possibility of incorporating such variables into the evaluation. Not only are current web-based flexible learning implementations compared against the 'conversational' framework, but also, using a grounded-theory approach, new variables can be incorporated into an enhanced framework as dictated by the data. This approach has led to further enhancement of the framework on which later parts of the research are based.

Methodology and scope of study

Scope of the study

For this study analysis was conducted on VET modules. To be eligible for this study, a module had to:

- be on offer during the data collection period
- lead to a VET-accredited qualification
- make use of networked computers for delivery, access to resources, communication or assessment
- offer students flexibility as to time, place, mode or content of study

Therefore, for a module to be eligible for inclusion, any learning resources on CD-ROM or computer disks had also to be supported by network connections, enabling 'conversations' beyond the local environment. These connections could be used to access teachers or tutors, and other resources as well as individuals other than teachers or tutors. Not all student activity needed to be online, however offerings needed to display flexibility for learners to be in scope for this project.

Overview of research methodology

This project on the evaluation of web-based flexible learning is descriptive and analytical in nature and has hence adopted quantitative and qualitative methodologies. A theoretical framework, conceptualised in terms of 'conversational' exchanges in the context of web-based flexible learning, underpins the research design. The research team made use of the framework for purposes of data collection and analysis. Data were gathered through a survey and case study methods as outlined below. Work undertaken in each of these phases was complementary in the sense of enhancing the interpretation of data, encouraging wider content coverage and facilitating multiple levels of analysis. Data were collected and used to instantiate the theoretical framework. However, in the latter part of the project, an emergent theory strategy was also used to add further weight to the utility of the framework and to incorporate modifications to that framework.

The research comprised four phases:

Phase 1: Phase 1 involved a survey of online VET offerings to gather descriptive data of current web-based flexible learning practices in relation to the evaluation framework and to open possibilities for modification of the framework.

Phase 2: The findings from phase 1 informed phase 2, in which detailed case studies were carried out. During the case studies, data were gathered at selected sites in line with the framework and evaluation tools previously developed. The focus of data-gathering was on learning, and data were gathered through observations and semi-structured interviews with teachers and students.

Phase 3: In this phase of the project, analyses were conducted of case study data. Emerging issues were identified.

Phase 4: In the final phase, work concentrated on a synthesis of findings and elucidation of implications and recommendations.

Survey

The aim of the survey was to gather basic data about web-based flexible learning modules from providers. Teachers were identified and their views were sought on how modules they were teaching were actually supporting 'conversational' exchanges for students working both online and offline.

Sample for the survey

A list of online VET providers in Australia was collated as a preliminary to determining modules in scope for the study. This was made possible through networking with EdNA (Education Network Australia) VET representatives from each State, staff from ANTA, as well as formal and informal networks comprising VET teachers and trainers. Searches were also conducted via the internet, visiting home pages of VET online providers and including such providers in the list of contacts. Information about the project together with an invitation to participate was published in ANTA *FastFacts*, the AVETRA newsletter, VET *NetWorker newsletter*, and postings to electronic lists such as VETLIST and TRDEV-AUS. Expressions of interest in the final outcomes of the project were overwhelming, although few of those interested were directly involved in offering modules within the scope of this study. Despite extensive searches, no national database of online providers could be found, so it is not certain whether the research team has been completely successful in inviting every online practitioner to contribute to the study. The fact that participation was voluntary could have excluded some practitioners who did not wish to take part. Nevertheless, every attempt was made to be inclusive, and while there are clearly a great many plans to implement more online flexible learning, surprisingly few modules actually had enrolments during the study period in 1998.

It was noted that most public and private VET providers were in the process of developing infrastructure, strategies and resources for online delivery in the near future. Several had already begun delivery using online technologies, but as beginners themselves, offered only limited number of web-based modules. Enrolment numbers were often limited to under ten students, suggesting that online delivery was not yet widespread even where modules were on offer.

Negotiations and site visits

The directors of provider organisations offering web-based flexible learning were formally approached for their consent and to invite their online course co-ordinators, teachers and tutors to participate in this study. Twelve directors consented to their staff participating in the survey. Eight others did not approve of this study being conducted in their institutions, stating the following reasons:

- Teachers were too busy at this time of the year.
- The institute could not see any commercial benefits from their participation.
- Staff were concerned about commercial-in-confidence nature of their materials and plans.

Negotiations took place with various providers with a view to ensuring co-operation (through mutual benefit) in the collection of data for case studies. The expectation was that if these providers had modules within the scope of the survey, then they would also be possible sites for case studies. These initial contacts also proved valuable in piloting survey forms and gaining feedback on other documents for the study.

Survey questionnaires

Two questionnaires, primarily for email distribution and return, were designed—one for course co-ordinators and one for teachers. The initial questionnaires were piloted with a group of TAFE teachers. Based on the feedback, the questionnaires were revised and are attached as appendix A. Co-ordinators were provided with a scope statement and asked to identify teachers of modules that were within the scope of the project. Questionnaires were then forwarded to teachers either by their co-ordinators or by the researchers directly. For the teacher questionnaires, elements of the 'conversational' framework, as discussed previously and summarised in figure 3, were used to guide the design. Questions encompassed all aspects of the framework. Background information, such as module titles, nominal duration and current enrolment was also sought. Definitions of selected terms were also included to ensure that interpretations for this study were consistent.

Administration of survey questionnaires

Electronic copies of the project brochure (appendix B) and the co-ordinators' and teachers' surveys (appendix A) were sent by email to executives of provider institutions. Where approval to conduct the survey was granted, executives were asked to nominate one teacher (most of whom were course co-ordinators) to liaise with the research team. These liaison officers were asked to forward copies of the brochure and questionnaires to teachers and other course co-ordinators with instructions to make multiple electronic copies as needed. A separate survey response was needed for each module in scope.

Completed surveys were returned directly to the project's senior research assistant, usually by email. The respondents also had email, facsimile and telephone access to the research team for any assistance with terminology or interpretation of the survey

questions. The administration of the survey instruments offered convenience and flexibility because of the email focus, but respondents were encouraged to use facsimile or post where this was more suitable for them. Assurance of confidentiality was provided to participants who were given a week to respond. The study co-ordinators were also requested to send a list of the recipients of the questionnaires to the senior research assistant who later followed up with late respondents.

In addition to the teachers who were contacted through study co-ordinators, survey forms were also sent to individuals who expressed interest in participating in the study after reading the postings in electronic discussion lists and published newsletters. Each respondent who returned a completed survey questionnaire was thanked individually and the names placed in a database for later dissemination of executive summaries.

Figure 3: Generalised 'conversational' framework with explanations and key phrases

Framework	Explanation	Key phrases
idea	One individual explains a concept. A listener tells back their own understanding of the concept and goes on to compare this concept with other known concepts. Similarly requirements for study and assessment may be discussed.	Concepts Requirements Discussing
action	A concept is used as the basis for formulating an action. The results of an action cause a concept to be revised.	Adapting Reflecting
	One person models and action and another attempts to copy it. The copy is imperfect so, with variations to emphasise selected aspects, the model is redisplayed and recopied.	Watching Practising

Management of survey data

Most of the surveys were returned by email or fax and initially stored in separate folders to facilitate follow-up of teachers and course co-ordinators. Data for each module in scope were transferred into an Excel spreadsheet. The use of this software allowed both quantitative and qualitative data to be entered and stored. This practice also offered the flexibility of importing data into other software such as SPSS for further analysis.

Analysis of survey data

Analyses were both theory-driven (searching for elements of the 'conversational' framework) and grounded (searching for all exchanges, which were later used to extend the framework). This approach provided both a means of verification of the relevance of the framework to web-based flexible learning and the potential to enhance the framework.

Table 3: Data coding for the descriptive framework

Coding term	Explanation of terms
Teacher–student	Students listening to or discussing with the teacher or watching what the teacher does
Student–student	Students listening to or discussing with other students or watching what other students do
Student–requirements	Students finding out about the mechanics and requirements of studying the module (e.g. due dates, where to find resources, how to use online help) by reading, listening, asking questions or searching
Student–other person	Students discussing and challenging ideas, concepts, principles etc. with teachers, tutors or other students
	Students watching teachers or others demonstrate a skill or how to do something
Student–course content	Students finding out about subject matter or content (e.g. terms and definitions, explanations of concepts or principles) by reading, listening, asking questions or searching
Student–application	Students practising skills or actually showing or demonstrating what they can do
Student–teaching methods	Describing the methods of teaching and delivery that are being used
Self-reflection/monitoring	Students taking ideas or concepts and developing or refining skills by adapting these ideas or students reflecting on practice to consider how skills might be changed, extended or improved

For the teacher survey, context data (questions 1–7) were accumulated and comparisons for the 'conversational' exchanges (questions 8–15) made. Using the 'conversations' as a basis, cluster analysis was used to align modules that were taught in similar ways. Snapshots in the form of graphs based on standardised scores were then constructed to enable visual comparisons of 'conversations' across clusters of modules. Qualitative data from open responses regarding critical events contributing to quality learning outcomes (question 16) and tools contributing to quality learning (question 17) were also examined using NUD*IST software to draw out underlying interactions. The responses were analysed line by line to capture instructors' perceptions of issues relating to teaching and flexible learning. These interactions were compared with those of the 'conversational' framework, which was then enhanced to include more context variables as a descriptive model. Table 3 provides a list of coding terms, with explanations, in this enhanced framework.

An additional purpose of the analysis was to identify issues that needed to be addressed in the case studies. To this end, the enhanced descriptive framework (in which the 'conversational' framework was embedded) was used as a basis for the case study analyses.

Case studies

In the case studies, the aim was to illuminate the evaluative framework by detailed examination of the form and extent of 'conversational' exchanges at two case study sites. Case study data collection methods were used to gain holistic views of the extent of communication pathways and online flexible learning in promoting learning.

Both teacher and student views were sought, contexts which could throw light on the 'conversational' exchanges were analysed.

Selection of case studies sites

Initial analysis of the data gathered through the survey informed the identification of sites for the case studies. Managers of VET providers that participated in the earlier survey for this research were approached to gain their support in the collection of data involving their staff and students. Accordingly, negotiations and site visits were organised to determine the range of possible case study sites. This resulted in four VET institutes two each in Queensland and Victoria. Ultimately, one site in each State was selected for case studies for this research. The selection of sites was determined by the following factors:

- the extent to which staff from the sites were willing to be involved
- the depth of information they were prepared to discuss
- the project budget
- time frames

The two sites chosen for the case studies presented different models of web-based delivery in order to allow the researchers to study different perspectives and evaluate these using the tools developed for the research. Both sites had elements in common, but used different models of web-based delivery. Further variations occurred within sites as tutors and students made choices among the available options. Differences within and between the sites facilitated assessment of the applicability and validity of the evaluation tools in different contexts.

Data collection for the case studies

At each site, individuals, as well as groups of teachers and students, were interviewed. Observations and group discussions were scheduled over three or four days at the convenience of staff and students at each site. To reach some of the remote participants, a few interviews were conducted online using First Class software. To allow exploration of the context, delivery systems and processes of teaching and learning, the interviews were semi-structured. Some questions were planned to ensure that information was requested on all aspects of the evaluative framework; others were open-ended and allowed respondents to comment on other issues of importance to them. This approach resulted in a very rich data set, which included crucial elements about the 'conversational' framework and other exchanges from the perspectives of staff and students.

Interviews in face-to-face settings were audiotaped with permission from the participants. The tapes were then transcribed and subsequently checked against the audiotapes to ensure that the full contents of the 'conversations' had been transcribed. The contents of online interviews were also saved and pooled with other transcripts.

Data management and coding

All interview data for the case studies were analysed using NUD*IST software, which was used to facilitate coding and to manage the data. The coding scheme is shown in table 3, derived from analyses of the survey data and the subsequent extensions to the 'conversational' framework. Coding terms were designed to capture both verbal and other types of exchanges such as demonstrating and copying, as well as 'conversations with self'. Conversations with self included self-reflection and monitoring one's own actions.

Where possible, each line of text was categorised using the codes extracted from the elements of the descriptive framework. The codes also indicated whether the responses were from teachers, students or both teachers and students. Multiple coding was assigned to text lines that supported more than one code. Members of the project team reviewed the coding, and revisions were made to ensure consistency before the final set of codes for each document was recorded. A range of reports that preserved line numbering and coding was extracted from the data. These reports enabled overviews of each case study site to be prepared and also provided quantitative data on the distribution and frequencies of coding to be entered into a statistical package (SPSS) for further analysis. As well as providing visual and statistical summaries of the data, analysis of patterns enabled underlying regularities to be identified. Analyses and results are reported in the chapter which follows.

Findings

From the survey

Given the high level of interest expressed in this project, the number of responses to the teachers' survey, as shown in table 4, was surprisingly small. While the marketing of web-based modules is widespread, many modules did not have enrolments in 1998, thus restricting the sample size (in terms of modules). Further, due to the commercial-in-confidence nature of their operations, many providers were reluctant to participate in the study or disclose detailed information about the design aspect of their web-based modules. In view of this, the development and trialling of an evaluative methodology for gauging online learning in VET is indeed timely. Findings from this report can now have a direct impact on the preparation of web-based modules for offer in the future.

Table 4: Number of responses (by modules) from each State/Territory

State/Territory	Number of responses (by module)
Australian Capital Territory	6
New South Wales	9
Queensland	36
South Australia	1
Victoria	10
Western Australia	12
Total	**74**

While respondents were predominantly from the TAFE (public provider) sector, modules from three private providers are also included. There were twelve providers in all for the 74 modules in scope. The higher apparent uptake of web technology in Queensland could be due to the closer working relationships between the research team and providers, implying higher trust with material deemed commerical-in-confidence. It is also worth noting that Queensland TAFE providers operate in a policy environment which promotes and co-ordinates web-based provision.

The modules surveyed represent a wide range of subject areas such as business, information technology, workplace health and safety and communication. A range of technical areas such as locksmithing, using graphics software and installing local area networks is represented. The data also included broader skill areas, such as help desk procedures and writing in the workplace. However, a considerable number of modules also dealt with less tangible areas such as the development of teamwork and interpersonal relationships. For most modules the nominal duration was 40 hours or

less (median=40) as is typical of VET provision. However, two 'modules' were reported to be of over 200 hours in duration. The number of enrolments reported for the modules ranged from 6 to 150. The median value was 31 from 73 included cases, again indicating the small-scale implementation of online learning in VET at the present time.

Quantitative data

Quantitative data from the survey and analyses are presented first, followed by an analysis of qualitative data.

The main quantitative data from the survey is derived from questions 8–15 of the survey questionnaire for teachers (see appendix A) and is related to the 'conversational' exchanges of the evaluative framework. Table 5 shows the questions (summarised by key phrases) and indicates valid cases and means for both 'online' and 'offline' parts to each question. Paired-sample t-tests indicate significant differences between 'online' and 'offline' responses. An explanation of the key phrases and their relationship to the framework can be found in figure 3 (see previous chapter).

Table 5: Summary of quantitative data from survey 'conversational' exchanges

		Online		Offline		Pairs	Differences	
Question	Key phrase	Mean	SD	Mean	SD	N	t	Sig
8	Requirements	3.6	1.47	1.9	1.49	41	3.96	0.00
9	Concepts	3.5	1.18	1.8	1.45	62	5.37	0.00
10	Discussing	3.4	1.43	1.6	1.31	42	5.13	0.00
11	Watching	2.5	1.87	1.6	1.67	41	2.06	0.05
12	Practising	2.4	1.53	2.4	1.69	43	0.00	1.00
13	Adapting	2.8	1.65	2.6	1.50	43	0.81	0.42
14	Reflecting	2.0	1.41	2.3	1.62	42	-0.88	0.38
15	Other activity	2.0	2.05	1.7	1.81	24	0.71	0.48

The data indicate that there were differences across modules between online and offline activities and between different kinds of 'conversational' exchanges. Overall, except 'reflecting', online exchanges outweigh those offline for each question. This is an indication that, while online activity dominated, offline activity was also expected of learners. A paired sample t-test for each type of exchange shows significant differences at the .001 level for 'requirements', 'concepts', and 'discussing' and at the .05 level for 'watching'. This indicates that online interactions were more important than offline interactions for receiving information (requirements and watching) and for verbal exchanges (concepts and discussing). The two modes were equally important for practising, adapting, reflecting and for unspecified activity. When offline activity alone was considered, practising, adapting, reflecting (which are perhaps more individual activities) are more dominant than receiving information and verbal exchanges.

These data provide an overall indication that the questionnaire is sensitive to all types of exchanges and to differences among them. The data also show that mapping of different types of exchanges in different circumstances is possible. Therefore it becomes possible to provide snapshots of teaching and learning in terms of these exchanges. Such snapshots can be used as the basis for judgements about the appropriateness of different teaching and learning strategies in relation to course objectives and content. Examples of such snapshots of activity are provided below.

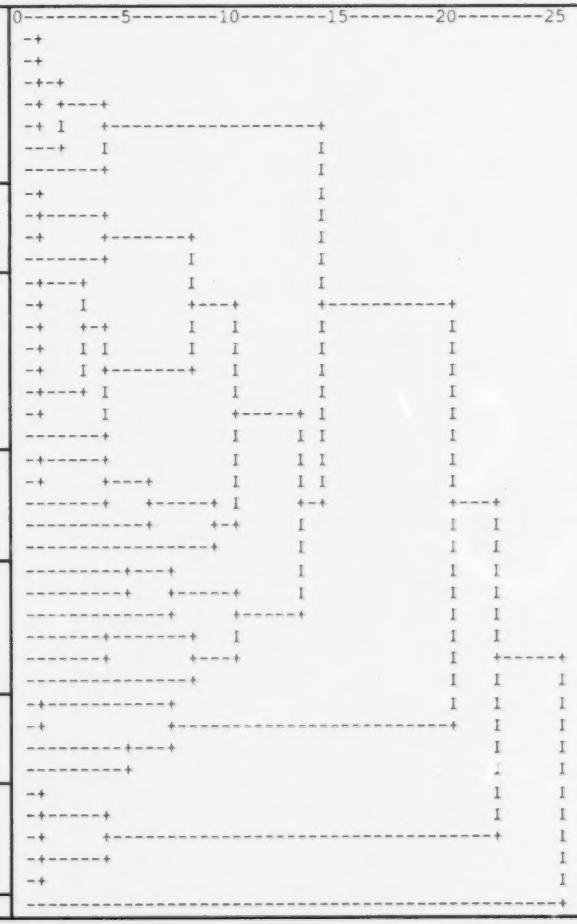
Although the data pool is too small to warrant multivariate data analyses, further analyses of similarity and differences among modules were undertaken. In order to explore the relationships between 'conversational' variables among different modules a cluster analysis was performed. Cluster analysis is appropriate because it does not rely on large samples or normative data. In this and subsequent numerical analyses of the questionnaire, data from question 15 (other activity) were not included. The large amount of missing data for this question indicates ambiguity in interpreting this question on the part of respondents. Similarly, only 40 (of the 74) modules were included.

Cluster analysis is a technique which draws together units which share common characteristics. In this case, modules are clustered that share similar patterns of 'conversational' exchanges, based on the squared Euclidean distance among the variables (that is, questions 8–14). In other words, modules which are similar in terms of the responses to questions 8–14 are brought into proximity. In the clustering technique used here, a hierarchical analysis with a visual display is used in which modules which share many characteristics are drawn close together in the resultant diagram.

Figure 4 shows the results of a hierarchical cluster analysis among modules. In the right hand column of the diagram, horizontal and vertical lines are drawn linking modules in a 'tree' structure. This tree lies on its side with the modules as the leaves on the left and the branches and trunk stretched out to the right. Also indicated by the tree branches, modules which share many characteristics are placed close together. Those which share fewer characteristics are separated vertically in the diagram. For example, the branching shows that the last entry in the diagram (module 61, freehand graphic software) is not closely related to any of the other modules. In the right hand column of the diagram the leaves-to-trunk dimension has a scale forming levels of similarity from 1 (at the leaf end) to approximately 25 at the trunk end. Dashed lines and boxes surrounding identification numbers (IDs) and module titles show how closely clusters of modules are related. Horizontal rules across the left-hand columns of the diagram are used to emphasise further the similarities of modules that cluster together.

Figure 4: Hierarchical clustering of 40 modules on questions 8–14 on- and offline

Cluster	ID	Brief module title
Relationships	73	Negotiation skills
	74	Dealing with conflict
	70	World War II women's lib
	71	National communications skills
	72	Team building skills
	60	Client interaction
	44	Introduction to front office
Teamwork	42	Meetings
	43	Meeting client needs
	41	Supervising teams
	57	Meetings
Business development	65	Cash control
	69	Small business management
	67	Career planning 2
	68	Career planning 3
	66	Career planning 1
	62	Work environment
	63	Writing in the workplace
	64	Business calculations
Personal development	4	Professional development
	59	Professional development
	14	Introduction to research
	13	Introduction to Australian government
	56	Workplace writing
Business systems	7	Small business management
	40	Business systems overview
	58	Support project
	1	Business systems overview
	2	Data communications
	3	Title not reported
Computer support	5	Installing and managing LANs
	6	PC support and management
	38	Hardware selection and purchasing
	39	Help desk procedures
Workplace know-how	11	Auto lock service 1
	12	Auto lock service 2
	10	Locksmithing fundamentals
	8	Communication and industrial relations
	9	Occupational health and safety
Unclassified	61	Freehand (graphics software)



Note: Modules listed close together share similar patterns of exchanges. Lines separating IDs and module titles (and dashed lines on the right) show clusters and relationships among modules.

While the clustering in figure 4 is derived from a statistical analysis, the cluster names have been imposed after the analysis was complete, comparable to the way in which factors are named in a factor analysis. These cluster names were chosen to reflect the contents of the modules which came close together (that is, are like one another). Thus each cluster is a group name for a set of modules which are similar in terms of the 'conversational' exchanges of the evaluative framework.

One explanation of this clustering, therefore, is that modules of similar content are taught in similar ways. For example, the cluster of modules labeled 'relationships' share similar kinds of teaching–learning (that is, 'conversational') exchanges. The cluster labeled 'teamwork', while distinct from 'relationships', has more in common with the latter than it does with the 'computer support' cluster in terms of how these modules are taught and learned.

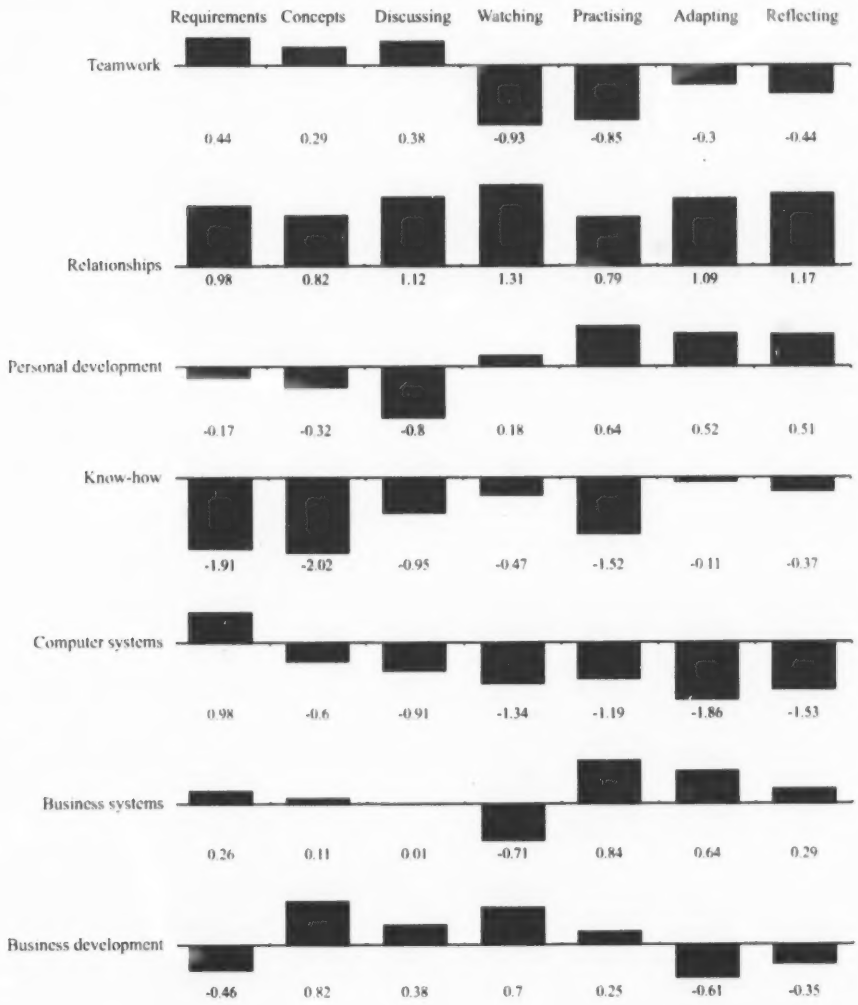
Table 6 lists the number of providers for the clusters derived from figure 4. The table shows that there are no more than three providers for any cluster and that most clusters (five in all) have only one provider. Thus another, complementary way to interpret the cluster analysis of figure 4 is that the sets of modules offered by the same provider are taught in a similar way (perhaps by the same teacher). So modules with similar content and which originate from the same provider tend to be taught in a similar way in terms of the online and offline exchanges that occur between students, teachers and resources.

Table 6: Number of providers for each cluster of modules

Cluster of modules	Different providers
Relationships	2 providers
Teamwork	1 provider
Business development	1 provider
Personal development	2 providers
Business systems	3 providers
Computer support	1 provider
Workplace know-how	1 provider
Unclassified	1 provider
Total	**12 providers**

Just as it is possible to map snapshots of teaching and learning exchanges for individual modules, so it is possible to provide snapshots of sets of related modules. Figure 5 shows the variation in teaching and learning exchanges across each cluster of modules (except for the unclassified module) for online exchanges. Similarly, offline exchanges are shown in figure 6. Standardised scores for each of the teaching/ learning variables are used for these analyses to facilitate comparisons across the variables. An effect of this standardisation is that the average of 'requirements' and each of the other variables is zero across the seven clusters. Positive and negative points show relative values above and below this mean. From these data, it is clear that different clusters are characterised by different patterns of online and offline activity.

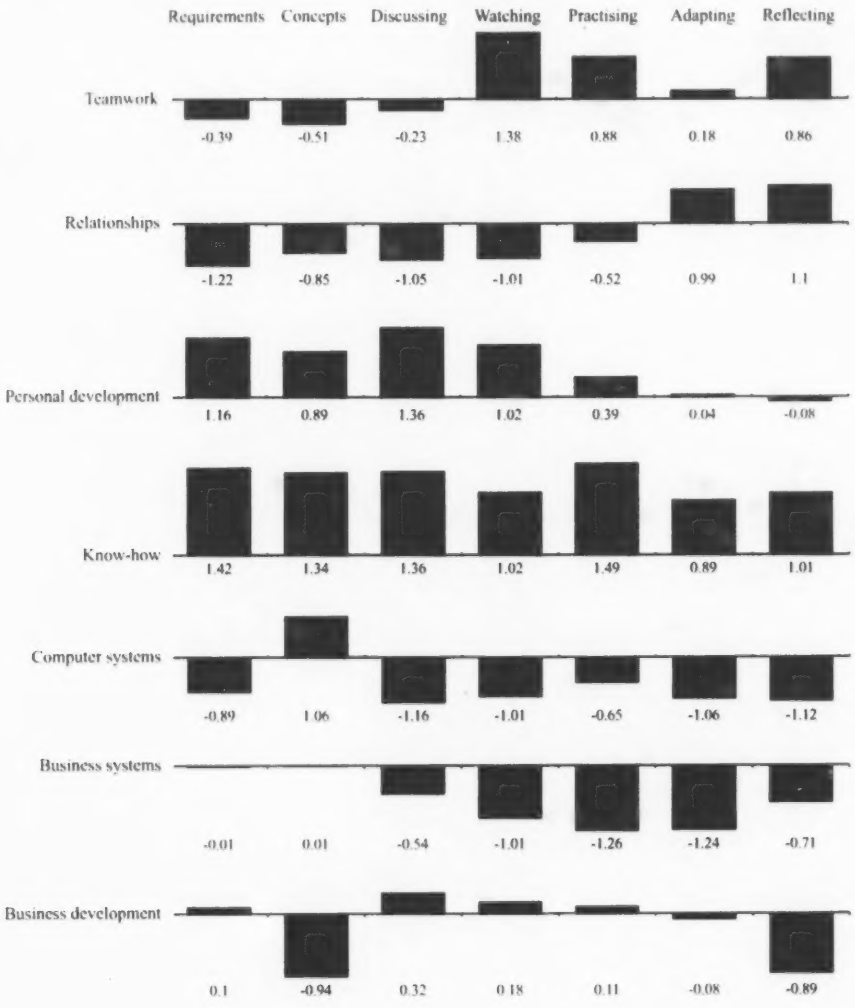
Figure 5: Variation in teaching/learning exchanges by module cluster online



Thus, the evaluative framework and methodology employed, and the quantitative data gathered from the survey, enabled profiles of teaching–learning exchanges to be mapped. It then becomes possible to make judgements about whether teaching–learning methods as mediated through online provision of VET modules are appropriate to the kinds of knowledge and skills for those modules. For example, the low levels of conceptual development reported for business systems both on- and offline would seem to be inappropriate. Similarly, the low levels of watching and practising on- and offline for computer systems does not seem conducive to developing skills in these areas. Furthermore, the relatively low levels of adapting and reflecting indicate that thoughtful monitoring and improvement activities by learners is not being encouraged. Of course, the survey gathered data only from a small sample and only from teachers of the modules, and more extensive testing of the framework and methodology is warranted. Nevertheless, the results are encouraging in that they

indicate that the methodology and the 'conversational' framework provide a basis for appraisal of online and offline teaching–learning exchanges, in a relatively efficient and straightforward way. Course co-ordinators and teachers could well make use of such tools in helping them to reflect upon and improve the quality of their web-based flexible learning offerings.

Figure 6: Variation in teaching/learning exchanges by module cluster offline



Qualitative data

Analysis of qualitative data focussed on open responses to questions 16 and 17 of the teacher questionnaire (appendix A). Question 16 sought to elicit from respondents critical events in their web-based teaching practice, events which, in their experience, struck them as significant instances of the kinds of teaching–learning practices

afforded by web-based methodologies. Question 17 sought information concerning significant tools and technical equipment used by providers in offering study modules. Insights relating to two kinds of inquiry were elicited. Firstly, information concerning relationships among different forms of interaction relating to the goals of learning were obtained. Essentially this knowledge is a qualitative elaboration of the 'conversational' framework explored from quantitative perspectives. Secondly, it was possible to construct a map indicating the kinds of critical learning interactions supported by web-based learning patterns within the sites of the survey. The purpose of this analysis was to make comparisons with the 'conversational' framework and to develop an enhanced descriptive model of the web-based flexible learning at the VET sites. A summary of these inquiries is presented in the following subsections.

Responses in relation to the 'conversational' framework

In answering the open-ended questions, respondents were not prompted in terms of the 'conversational' framework (see figure 3). Nevertheless, many answers could be classified in accordance with this scheme, indicating that the kinds of interactions being mapped arise naturally from discussions of teaching and learning. Typical responses provided by the respondents are shown below under categories from the framework.

Responses indicating engagement with 'ideas':

- *The ability to deliver electronic customised tutorials to individuals.*
- *Students using the annotation system to contribute useful information information for the benefit of the entire class.*
- *Students communicate via the café* [Forum Notice Board]. *They also use competencies from other modules.*
- *Quality of learning outcomes vastly improved through online class discussion. I confirm the correctness of their conclusions.*

Responses indicating 'adaptation and reflection':

- *Self-directed groups with the instructor as facilitator are immensely effective, provide a more accurate method of assessment.*
- *Reflecting on data gathered in the context ...*

Responses indicating 'action':

- *Students were required to physically install software with which they were unfamiliar and provide a practical demonstration to prove the successful installation of the software.*
- *Students used a CD to simulate interviewing techniques to assist them through a module covering information gathering methods.*
- *Students get weekly tasks via email. They may complete the task, which involves finding info on the net and processing at their chosen site.*

Mapping the kinds of learning interactions

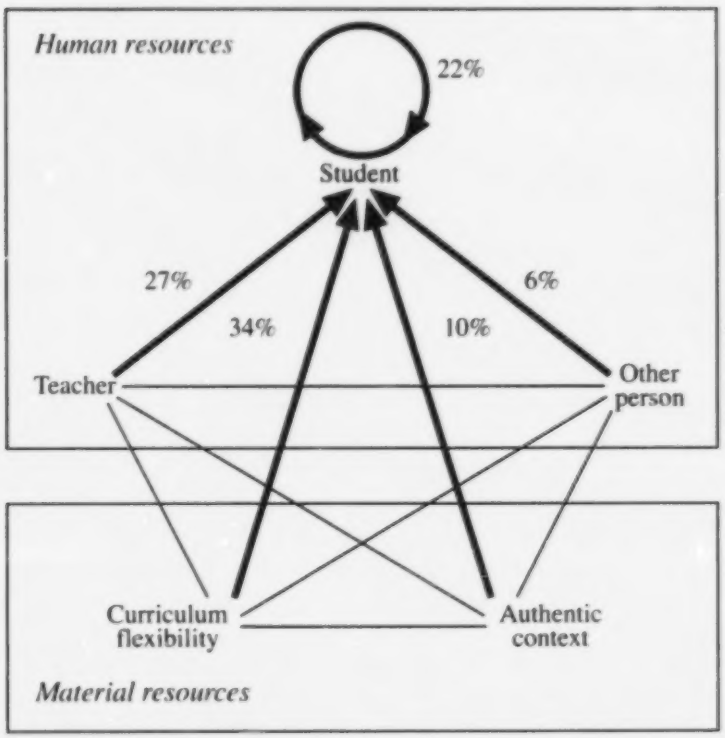
As well as analysing for interactions of the 'conversational' framework, a more comprehensive analysis was also undertaken to further illuminate all kinds of learning interactions that were occurring. As a check on the comprehensiveness of the 'conversational' framework, responses to the open-ended question on critical incidents (question 16) were scanned to gauge the variety of interactions supported by web-based techniques. In reviewing the data, pathways of information flow for teaching and learning processes were identified as shown in table 7. This table provides a summary of the range, distribution and incidence of interactions for modules in scope. Two of the main categories were subdivided. Curriculum flexibility was subdivided into student–requirements and student–teaching method interactions; and interactions relating to authentic contexts were subdivided into student–course content and student–application. The total number of interactions reported among the 74 courses in scope was calculated to be 77 (a mean of 1.3 per course). All sites exhibited at least one type of interaction and most sites showed two of them. No sites in the survey made use of three or more of these interaction types. In order to display these results more clearly, a directed graph was used to map the kinds of interactions cited by respondents, as shown in figure 7.

Table 7: Distribution and incidence of interaction types by module ID

Type of interaction	Module ID	Total incidence
Student–student	8, 41–55, 57	22%
Teacher–student	5–8, 16, 41–56	27%
Student–other person	10–12, 38, 39	6%
Curriculum flexibility		34%
(Student–requirements)	2, 3, 16–37	(31%)
(Student–teaching methods)	60, 61	(3%)
Authentic context		10%
(Student–course content)	9–12, 58	(6%)
(Student–application)	37–39	(4%)
Self-reflection/monitoring		0%

From figure 7, it can be seen that information appeared to be transacted among three categories of people—students, teachers, and other people related to field practice. The interactions occurred as these people variously examined, extended and modified (and exercised modifications upon and were informed by) curriculum knowledge and practice (curriculum information, teaching methods, learning options and flexibility), and information pertinent to authentic learning contexts (workplaces, other field sites). These elements (designated 'student', 'teacher', 'other person', 'curriculum flexibility', 'authentic context', respectively) were conceptualised as labeled vertices of a directed graph (see figure 7). Note that, of these web learning vertices, three relate to human resources and two relate to material and contextual resources In the directed graph, bolded edges (lines) are associated with the interaction types identified in table 7. Other edges indicate the kinds of interactions which, though logically possible, were not found in the data set analysed.

Figure 7: Descriptive teaching–learning model arising from the data analysis



The results show that the largest percentage of interactions related to communication with students about the requirements of the course (31%). By contrast, the capacity of web learning technology to facilitate interactions relevant to authentic situations (student application: 4%) and in ways which were flexibly offered to students for study (student teaching methods: 3%) were encountered least often. There was no incident of student self-reflection or monitoring reported.

From this analysis, the most interactions afforded by the web learning technology within the scope of this study were among human resources (55% of interactions), whereas the remainder was between human and material resources (44%). Absent from the data obtained was evidence of the following interactions:

- teacher–other person relevant to the course
- teacher–authentic context
- teacher–curriculum flexibility
- other person relevant to the course–authentic context
- other person relevant to the course–curriculum flexibility
- curriculum flexibility–authentic context

Given that web technology now makes the possibility of these interactions feasible, and given the advisability of extending the range of interactivity for the purposes of enhancing the quality of learning, this finding is of significance. Indeed, these

descriptive findings suggest that while the current take-up of web technology has facilitated important pathways of communication, these have tended to duplicate pre-web styles of interaction, rather than make use of a range of interactions now accessible with current technology, most notably interactions with authentic contexts and with persons other than students and teachers.

The analysis also demonstrates that most elements of the 'conversational' framework are present in the descriptive framework. The only exception is 'self-reflection' and its absence may be due to the fact that students were not surveyed in this phase of data collection. Thus the descriptive framework embeds the essence of the 'conversational' framework, but also provides extensions of the inclusion of context variables. Since the descriptive framework was obtained from open-ended questions (rather than the prompted questions used for the initial analysis of the 'conversational' framework), further weight is added to the legitimacy of the conversational framework.

From the case studies

The methodology and tools used in the examination of two case studies suggest that the 'conversational' framework is an effective basis for the evaluation of web-based flexible learning. This evaluation is based on theoretical constructs that reflect widely held views about what constitutes good teaching and learning. In this section, the evaluation framework is explained before the main findings are presented. A discussion of the findings of the case studies concludes the section.

The results indicate that a teacher-centred approach to teaching is dominant for the case studies examined. However, web-based flexible learning also offers potential for student-directed learning as an alternative to teacher-centred learning methods. The nature and frequency of interactions promoted through web-based programs have the potential to support and enhance adult learning, with an emphasis on self-determination and learning in authentic contexts. For instance, increased self-directed learning encourages individual student engagement and self-reflection, both essential for lifelong learning. Instructional designers of web-based programs need to take advantage of the capabilities offered by technology by ensuring that content materials encourage rich 'conversational' interactions and that student self-directedness and reflection are also encouraged.

Evaluation framework for the case studies

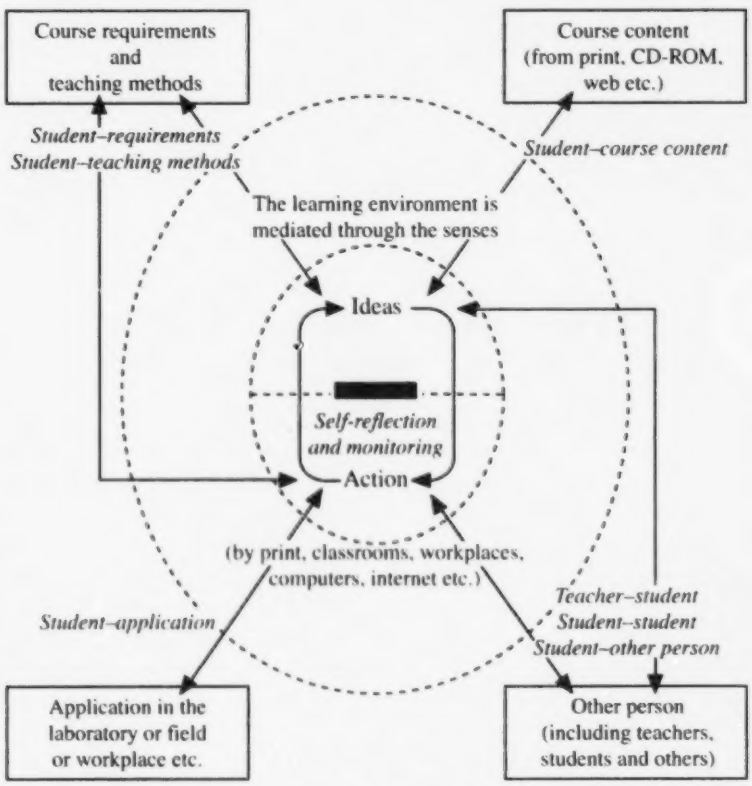
Laurillard's (1993) 'conversational' framework for the evaluation of educational media, was enhanced for the purpose of this research. This model is grounded on the premise that good teaching and learning involves rich 'conversations'.

Laurillard's model has been generalised by McKavanagh (1997) to be more reflective of adult learning environments and to capture the different kinds of exchanges that occur in resource-based flexible learning contexts, as well as in face-to-face interactions. This generalisation of the 'conversational' framework makes it suitable

for mapping exchanges essential for deep, reflective and effective learning in vocational education domains because:

- The model centres on the learner in adult education as it is not always clear who or what is doing the teaching.
- The model centres on the learning environment in flexible learning mode as a generalisation of a traditional walled classroom.
- In the model, action is separated specifically from ideas in view of the importance of application in vocational settings.

Figure 8: Enhanced framework used as the basis of the evaluation



(Terms in italics along the arrows are used in coding the data)

Following the preliminary analysis of the survey data, the evaluation framework was further enhanced to capture more elements of the learning environment. In the extension of the earlier work reported here, the learner remains at the centre of the 'conversational' model, but is surrounded by the key curriculum elements of course contents, course requirements, teaching methods, application in the laboratory, field or workplace, and other persons. This enhanced framework not only retains the 'conversational' exchanges as a subset but also places these exchanges within a broader set of contextual factors. Figure 8 shows these various elements and the relationships

among them. Terms in italics along the arrows were used in coding interview transcripts for the case studies and are explained in table 3.

Analysing case study data

Initially, analyses searched for patterns of interactions (as coded in table 3) in the data, separately for each of the two cases. Two types of patterns of interactions (labeled emphasis and associations) emerged in each case study from these analyses. Further analyses on each of these patterns were then performed. These results are discussed in the next sections.

Patterns of emphasis

The term *emphasis* reflects the relative frequency or importance given to particular exchanges in the data. However, absolute frequency counts do not convey importance across students, teachers and cases because of the differing numbers of staff, students and utterances involved in the case studies. Therefore, counts relative to the total numbers of units are used as the basis of comparison across groups. Accumulation of the data into rank order of the categories provides a further basis for comparisons of the ways in which the various groups attribute importance of particular types of exchanges. The ranks reflect the importance given to particular interactions by teachers and students. Results for each of these analyses are provided below. In each case study, teachers and students expressed all types of interactions found in the 'conversational' framework. This indicates that no types of exchanges among students, teachers and resources were precluded by the technology and teaching methods employed. For case study one, table 8 compares, teachers' and students' emphases for different types of interactions. There are some differences amongst perceptions of teachers and students. However, a correlation test also shows a significant correlation at the .05 level between the rank order of teacher's and student's emphasis (Spearman rho=.766; p=.027), so teachers and students at this site see the emphases in similar terms. When teacher and student data are combined, the weighted ranks are as indicated in the final column of table 8. Greatest emphasis is placed on teaching methods and students knowing what is required of them. Least emphasis is placed on interactions that are more student-directed, such as student engagement with the course content, students reflecting, self-monitoring and dealing with people who are not students or teaching staff.

In a similar way, table 9 compares, for case study two, teachers' and students' emphases for different types of interactions. As with case study one, there are some differences between teachers and students. However, as in case study one, there is also a significant correlation at the .05 level (Spearman rho=.833; p=.010) between the rank order of teachers' and students' emphasis. Therefore, teachers and students at this site also see the emphases in similar terms. Table 9 also shows teacher and student data when combined as weighted ranks. As with case study one, least emphasis is placed on self-directed activity on the part of students. Greater emphasis is placed on more teacher-centred interactions, such as students interacting directly with teachers or with teacher-prepared materials in terms of teaching methods and requirements.

Table 8: Analysis of patterns of emphasis in coded lines of transcripts from case study 1

Case study 1	Teachers (454 lines)		Students (259 lines)		Teachers and students (646 lines)	
Interactions	Count	Rank	Count	Rank	Count	Weighted rank
Student–teaching methods	191	1	96	2	273	1
Teacher–student	137	3	54	4	167	4
Student–requirements	144	2	82	3	193	2
Student–application	86	4	97	1	160	3
Student–student	42	6	35	5	77	5
Student–course content	25	7.5	34	6	43	7
Self-reflection/monitoring	51	5	26	7	61	6
Student–other person	25	7.5	3	8	28	8
Average codes per line	1.5		1.6		1.6	

Notes: 1 Some lines include responses from both teachers and students.
2 Weighted ranks adjust for unequal numbers of lines.

Table 9: Analysis of patterns of emphasis in coded lines of transcripts from case study 2

Case study 2	Teachers (650 lines)		Students (219 lines)		Teachers and students (753 lines)	
Interactions	Count	Rank	Count	Rank	Count	Weighted rank
Student–teaching methods	391	1	103	1	420	1
Teacher–student	257	2	64	2	275	2
Student–requirements	227	3	47	3	239	3
Student–application	210	4	46	4	216	4
Student–student	86	7	40	5	105	6
Student–course content	121	6	38	6	131	5
Self-reflection/monitoring	128	5	19	8	128	7
Student–other person	39	8	34	7	57	8
Average codes per line	2.2		1.8		2.1	

Notes: 1 Some lines include responses from both teachers and students.
2 Weighted ranks adjust for unequal numbers of lines.

Pooled data for teachers and students from both case studies provide an overall picture of the emphasis for the eight types of interactions, as shown in table 10. This combination of ranking by teachers and students from both cases shows that students' interaction with teaching materials was the most important of the eight types of interactions. Other important interactions were students' interacting with teachers and students' establishing the requirements of study and assessment. Students' interaction with persons other than teachers and peers was ranked as least important of the eight. These patterns were similar in responses by teachers and students within each case study. Low-ranking categories included interactions among students (rank = 5), with course content (rank = 6), self-reflection/ monitoring (rank = 7) and with persons other than teachers (ranking = 8). Least important interactions were those dealing with self-directedness on the part of students.

Table 10: Analysis of patterns of emphasis expressed as an overall rank order of interactions for both case studies

Interactions	Weighted ranks by teachers and students from both case studies		
	Teachers	Students	Total
Student–teaching methods	1	1	1
Teacher–student	2	4	2
Student–requirements	3	3	3
Student–application	4	2	4
Student–student	7	5	5
Student–course content	6	6	6
Self-reflection/monitoring	5	7	7
Student–other person	8	8	8

The results imply that the emphasis is not, as expected, on the learning of content, but rather on teaching methods. It appears that technology impacting on teaching methods has greater importance for teachers and students than do other interactions such as application, peer discussion, discussion with persons other than teachers, and self-reflection. The dominant pattern of teaching and learning is a teacher-centred one in which the main flow is from teacher (or teacher-prepared materials) to students, rather than one in which students engage with the course content and reflect on what they have been learning and doing.

Patterns of association

The concept of *association* focusses on typical sets of interactions in order to obtain information about what could be referred to as preferred styles of teaching and learning within the case study sites. It is apparent from the above analyses in relation to emphasis, that certain types of interactions were favoured over others by many students and teachers. However, in the above analyses one interaction at a time is considered, despite rank correlations (as discussed above) which indicate that several types of interactions may be acting in concert. More powerful multivariate analytic techniques allow several variables (that is, interactions) to be examined simultaneously. Factor analysis is such a technique, one which can also identify patterns of associations in the data. In this case it is a means of identifying sets of interactions that tend to occur together, and which can be thought of as a teaching–learning style. In line with a constant theme in the literature for a dimension of style from teacher-centredness at one extreme to learner-centredness at the other, a one-factor solution was sought. A principal components' factor analysis was used to derive the dimension from patterns in the data. Analyses were conducted on each case separately and again for the combined data. Results are shown in table 11.

The pattern of results found in table 11 is consistent across both case study sites and the combined data, as indicated by similar positive and negative factor loads. The factor (or dimension) represented by these loadings has been named teacher–student centredness. The high positive loadings on four types of interactions that do not involve teachers or peers (student–requirements, student–course content,

student–self-reflection/monitoring, and student–other persons) represent the student-centred end of the dimension. The strong negative loadings on interactions between student–teaching methods and student–teacher represent the teacher-centred end of the dimension.

Table 11: Analyses of patterns of associations from the case studies: single factor, principal component loadings

Variables	Case study 1	Case study 2	Both studies
Student–teaching methods	**-.46**	**-.61**	**-.54**
Teacher–student	**-.45**	**-.55**	**-.56**
Student–requirements	**+.31**	**+.53**	**+.49**
Student–application	-.20	+.14	+.01
Student–student	+.14	-.26	-.11
Student–course content	**+.67**	**+.45**	**+.52**
Self-reflection/monitoring	**+.56**	**+.34**	**+.47**
Student–other person	**+.55**	**+.48**	**+.47**
Eigenvalue	1.7	1.6	1.6
% Variance accounted	21.0	19.8	19.6

Note: Factor loadings above +0.30 and below –0.30 are highlighted.

Essentially, there was a frequent pattern of associated teaching and learning interactions (teacher–student centredness) that were common at both case study sites. This set of associations forms a continuum which varies from high levels of student-centred learning (the positive end of the scale) to interactions which maximise teacher-centred learning (the negative end of the scale). Thus, on the positive end of the dimension, learners engage in interactions more independently. At the negative end of the dimension, the style tends to be one where students interact with teachers rather than engaging in individual pursuits in learning. Both ends of the scale were represented in the data, although, as noted in the study of *emphasis* above, teacher-centred approaches dominated.

Discussion of case study findings

The picture that emerges is that the technology and arrangements for flexible learning is being used to extend traditional teacher-centred approaches to off-campus learners, rather than providing for new approaches to teaching and learning. Nevertheless, independent student engagement, linked more to adult learning principles than to traditional classroom methods of learning, is also occurring. This independent learning is associated with rich teaching and learning interactions.

The findings have two main implications: firstly, the uptake of technology in flexible learning gives new life to traditional teacher directed learning (for example, teacher-prepared materials are placed on the web for access by students at times more suitable to them); secondly, technology also provides alternative approaches by encouraging and supporting more independent learning with greater active engagement among autonomous learners (for example, individual project work in which students search

the web for information to define or research a topic or to solve a problem). These more independent learning examples represent more innovative ways of using the technology to extend teaching and learning such as Tinkler, Lepani and Mitchell (1996) advocate and involve the kind of deep engagement that Stevenson (1994) suggests as essential for the development of technical expertise. Theorists such as Brookfield (1988), Candy (1987) and Knowles (1975) also champion such approaches for adult learning, giving further substance to the view that technology-based flexible approaches have the potential to provide for self-directed learning.

Overall findings

The overall findings of this study can be summarised as follows.

Web-based technology uptake in 1998

- A high level of interest was evinced in the evaluation of web-based flexible learning amongst providers and teachers.
- The number of modules in the survey was surprisingly small because many advertised modules did not yet have enrolments and because almost half of providers (8 out of 20) were reluctant to disclose detailed information for commercial reasons.
- In 1998, 74 modules from 12 providers in the scope of the survey. These were predominantly from TAFE institutions (public providers) but also included private providers. By projecting from these figures and the number of refusals to participate in the study, it can be estimated that approximately 120 modules were offered in web-based flexible learning mode in 1998. The median number of students in the modules surveyed was 31, with a range of 6–150. These modules involved a total of about 2300 students. (In 1998 there were approximately 1.54 million VET students in Australia.)

Module characterisitcs

- The modules surveyed varied widely. Modules represented a wide range of subject domains (business, information technology, workplace health and safety and communication), including many technical areas (locksmithing, using graphics software and installing local area networks) and spanning a broad range of skills (for example, help desk procedures, writing in the workplace). A considerable number of modules dealt with less tangible areas such as the development of teamwork and interpersonal relationships.
- For most modules the nominal duration was 40 hours or less (median=40) as is typical of VET provision. However, two 'modules' were reported to be of over 200 hours in duration.

Evaluation of web-based learning tools

- The development and trialling of an evaluative methodology for gauging online learning in VET is indeed timely, as outcomes from this project can have a direct impact on future web-based modules on offer.
- The 'conversational' framework and its enhancements form an effective basis for the evaluation of web-based flexible learning. The tools developed provide an efficient means of data-gathering and analysis, leading, for example, to 'snapshots' which map learning activity.
- Teacher-centred approaches are dominant in current offerings despite the great potential of web-based flexible learning to engage learners in problem-solving, responding to change and improvement through self-monitoring and self-reflection.

Future directions for web-based learning environments

- The nature and frequency of interactions promoted through web-based programs have the potential to support and enhance lifelong learning with an emphasis on learner-directed learning and adaptability.
- Instructional designers of web-based programs need to take advantage of the capabilities offered by technology in ensuring that content materials encourage rich 'conversational' interactions and that student self-directedness and reflection are encouraged.

Research outcomes

Tools to aid evaluation

This research has led to the development of tools for the evaluation of web-based flexible learning in VET. These are listed in table 12. As indicated in that table, each of the tools draws on either the 'conversational' framework or the enhancement of that framework as developed during the course of the research. The tools are of two types—those that assist in the gathering of data for evaluations and those that assist in the analyses and display of results. Table 12 also indicates the location in the report in which further details of the tools can be found.

Table 12: Evaluative tools for data-gathering and analysis

Tools	Framework	For more details see
Data gathering		
• Email surveys of teachers	'Conversational'	Appendix A
• Interviews and computer-based discussion with individuals and groups	Enhanced	Findings
Data analysis and display		
• Cluster analysis of quantitative data	'Conversational'	Findings (table 5 & figure 4)
• Snapshots of teaching–learning interactions	'Conversational'	Findings (figures 5 & 6)
• Mapping the kinds of learning interaction	Grounded-theory	Findings (figure 7)
• Coding of interview data using Nudist	Enhanced	Findings (tables 8–11)

The email surveys facilitate an efficient means of gathering quantitative data about teaching–learning 'conversations' which can then be analysed through cluster analysis and displayed using the snapshot graphing tools. Similarly, the interview and data-coding tools facilitate more detailed analysis of qualitative data. The tools are helpful in indicating the range and quality of learning activity and therefore assist in making judgements about the appropriateness of instructional design and teaching methods.

Research outcomes for practice

'Conversations' in web-based flexible learning

From this research, it is clear great interest and potential in web-based flexible learning for the VET sector exists. While the internet is central to this teaching–learning mode, it should be noted that complementary offline activities are also important for good practice. What is needed for good learning is a wide range of deep 'conversational' exchanges which involve authentic practice and rich discussions among teachers and groups. As well, individuals need to be engaged in similar 'conversations with self' as, for example, through self-reflection and self-monitoring of activities. The kinds of

'conversational' exchanges identified in this study are shown in table 13 where examples are also given.

Table 13: Examples of 'conversational' exchanges

'Conversational' exchanges	Examples
Requirements	due dates, where to find resources and how to use online help
Concepts	terms and definitions, explanations of concepts or principles
Discussing	'conversational' exchanges to challenge ideas, concepts, principles etc. and to make connections among related terms
Adapting	application of ideas and concepts for the development, monitoring and refinement of skills
Reflecting	thinking about practice and considering the application of skills or their expansion and improvement
Watching	observe teachers or others demonstrating a skill, process or method
Practising	rehearsing skills, showing or demonstrating skills

The theoretical framework underpinning the evaluation was developed from Laurillard's 'conversational' theory (see figure 2) in which the main types of reciprocal exchanges are idea to idea, action to action and idea to action. This research facilitates the mapping of those exchanges for particular modules, clusters of modules and courses. While it is not possible to recommend how frequently each type of exchange should take place for any one course, all of these types of interactions are important, as explained by Laurillard (1997):

> *It is hard to predict the optimal balance of time a student should spend in working on learning materials, participating in discussion, reading, writing, listening, practising. It will vary from one subject to another, and according to the way a course is designed by its teachers. The balance will evolve with practice.* (Laurillard 1997, p.176)

Good practice in web-based learning settings will be driven by teachers and/or designers paying attention to effective use of 'conversations'. As in traditional classrooms, good practice is more than just stringing together a variety of 'conversations' per se. It is important that practitioners understand that, like the teaching strategies adopted in traditional classrooms, 'conversations' need to be appropriate and linked to the learning outcomes they are seeking to achieve. The framework developed for this research and outlined above can assist in promoting a set of coherent 'conversations'. Moreover, the general nature of this framework ensures that it is applicable in a wide variety of learning contexts in vocational education.

Because of the grounded-theory approach also adopted in this research, the 'conversational' framework was also enhanced by the incorporation of relevant context variables. This revision is referred to as a descriptive framework but the 'conversational' framework is embedded within it. The exchanges of the descriptive framework are: student–teaching method; student–teacher; student–requirements; student–application; student–student; student–course content; self-reflection/ monitoring; and student–other persons. This enhanced framework was used for the

case studies and is the basis of the tools associated with the gathering and analysis of interview data.

Implications for delivery

A diversity of modules were within the scope of this research illustrating that web-based flexible learning can make use of 'conversational' exchanges both on- and offline in the pursuit of learning outcomes. Modules represented such subject domains as business, information technology, workplace health and safety and communication. Technical areas spanned locksmithing, using graphics software and installing local area networks. Skill areas such as help desk procedures and writing in the workplace were included. A considerable number of modules dealt with less tangible areas such as the development of teamwork and interpersonal relationships.

Many forms of interactions are possible. There are no best 'conversational' methods. Rather, certain methods and combinations of methods are better than others at achieving different learning outcomes. For example, watching and practising are keys to the development of routine procedures. Designers and teachers can establish the best combinations through monitoring and evaluation of practice. What is evident is that good teaching in web-based flexible learning will involve engaging learners in rich 'conversations'. The tools developed in this project facilitate the efficient collection of data and mapping the extent of the various kinds of 'conversations' that occur. These maps provide snapshots for teachers (see figures 5 and 6) who are then in a better position to judge the worth of various activities and to adjust the learning environment to cater better for student needs and curriculum objectives.

Implications for the knowledge economy

As indicated previously, web-based flexible learning can support the kinds of learning needed for the knowledge economy of the information society. These are lifelong learning, learner-directed learning, learning to learn, contextualised learning, customised learning, transformative learning, collaborative/co-operative learning and just-in-time learning (Tinkler, Lepani & Mitchell 1996). The evaluative tools provided in this research can help practitioners explore and expand the kinds of flexible learning 'conversations' which extend the breadth of experiences for adult learners.

Implications for course design

The 'conversational' nature of teaching and learning provides a useful way for course designers and teachers to conceptualise their practice. Such 'conversations' should be thought of as including exchanges other than just face-to-face contact and so are inclusive of all types of interactions inherent in resource-based and web-based learning. As Stevenson (1994) argues, for learners to achieve expertise, then learning must be deep, conceptual and reflective, with strong links between concepts and practice. Teachers need to fashion learning experiences and 'conversations', or combinations of 'conversations', that lead learners to expertise. This is similar to the ways in which teachers align their teaching strategies to the learning tasks at hand.

This research has confirmed the common kinds of 'conversations' evident in current practice and the theoretical framework adopted by the study gives guidance as to what other sorts of 'conversations' can be strengthened.

Implications for evaluation

In attempting to determine the effectiveness of alternative web-based flexible learning systems, there is a need to categorise and compare groups of users as well as describe characteristics of interactions of individuals within the same system. The analytic tools provided here will assist this task. Evaluation tools developed or refined in this research are useful and timely in that they can be used to improve courses through an analysis of learning activity in relation to context and outcomes.

During the evolution of web-based flexible learning, teachers need to experiment with and continually evaluate their practice in a systematic way. For the teacher, the problems lie in how to document and analyse learner interactions with such systems. To date many web-based flexible learning systems have employed an intuitive approach to interface design, but alternative systematic and theory-driven approaches are emerging. The tools provided here assist with systematic documentation of student learning activity, although tools from other authors can provide complementary detail.

Nelson, Harmon, Orey and Palumbo (1993) are most informative on this front. They discuss several techniques for collecting and analysing user interaction data that have been found effective, including both quantitative and qualitative procedures. In broad terms they describe the methods as:

- characterising user interaction using path algebra and directed graphs
- using social interaction methods to analyse user/system interactions
- using qualitative methodology to generate theory about user interactions

The methods range from simple frequency counts to complex path algebra, from protocol analysis to ethnographic studies. Thus, teachers need to utilise new and efficient techniques for analysing patterns of user interaction. The tools from this research provide an easy-to-use starting point.

Implications for further research

An understanding of how web-based flexible learning can be developed effectively is far from complete. As the development of web-based flexible learning systems continues, it is important to develop appropriate evaluation tools. Such tools need to take account of how to document and analyse learner interactions with such systems. The tools must also take account of the fact that nonlinearity and associativity can be represented in numerous ways, and accommodate the importance of both the knowledge representation and interface issues. This study has made a start in assisting teachers to undertake systematic evaluations of their web-based flexible learning efforts by providing an evaluative framework and some efficient means by which to gather, analyse and present results. Further research is needed, however, into how web-based flexible learning programs affect learners and the ways they learn.

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Appendix A: Survey questionnaires

Two questionnaires were designed for administration by email. The coordinator's survey identified modules within the scope of the project. The survey to the teachers of these modules gathered detailed information about teaching and learning and the web-based flexible learning context in which learning was occurring. In this appendix, the teacher's survey is presented before the coordinator's survey. Contact details on both surveys have been brought up to date and formatting has been adjusted to suit this report style.

Survey questionnaire for teachers

Survey to TEACHERS or TRAINERS offering VET modules online:

Evaluation of web-based flexible learning

Our email address is: c.mckavanagh@mailbox.gu.edu.au

This survey aims primarily at describing VET flexible learning modules CURRENTLY offered online. (See scope definition below.) A fuller description of the project is in a separate email. The information will be used to improve web-based flexible learning. A final report of the project is expected before the end of 1999. This survey is designed for email; however, if another format is more convenient for you please make use of it.

It has been suggested that a module you teach or coordinate is within the scope of this project. To be in SCOPE a module must have ALL of the following characteristics:

- have students enrolled in Australia at some time during 1998
- use networked computers for delivery, access to resources
- communication or assessment
- offer flexibility as to time, place, mode or content of study
- be in the area of vocational education and training (VET)

The body of this email is a template; please complete and return a copy of this template for each of your modules in scope.

****

START OF TEMPLATE (Make copies as needed)

We would like to know about EACH MODULE that is within scope.

CONTEXT OF THIS MODULE

1. Title and code of this module [ ]
2. Name of teacher or module coordinator [ ]

   Email address of module coordinator [ ]

   Phone number of module coordinator [( )]
3. Internet address of this module (if available) [ ]
4. Length of module: total nominal hours [ ]
5. Courses or qualifications to which this module belongs [ ]
6. Number of students at last (or current) offering for this module [ ]
7. Please describe the ways in which the learning for this module is flexible (e.g. in terms of time, place, mode or content of study).

TEACHING–LEARNING STRATEGIES FOR THIS MODULE

For Q8–Q15 consider how students spend their learning and assessment time and how this time is divided between working at computers and other activities.

8. Type a code to describe how often a TYPICAL STUDENT does this:

Students finding out about the mechanics and requirements of studying the module (e.g. due dates, where to find resources, how to use online help) by reading, listening, asking questions or searching.

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

9. Type a code to describe how often a TYPICAL STUDENT does this:

Students finding out about subject matter or content of the module (e.g. terms and definitions, explanations of concepts or principles) by reading, listening, asking questions or searching.

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

10. Type a code to describe how often a TYPICAL STUDENT does this:

Students discussing and challenging ideas, concepts, principles etc. with teachers, tutors or other students.

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

11. Type a code to describe how often a TYPICAL STUDENT does this:

Students watching teachers or others demonstrate a skill or how to do something.

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

12. Type a code to describe how often a TYPICAL STUDENT does this:

Students practising skills or actually showing or demonstrating what they can do.

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

13. Type a code to describe how often a TYPICAL STUDENT does this:

Students taking ideas or concepts and developing or refining skills by adapting these ideas.

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

14. Type a code to describe how often a TYPICAL STUDENT does this:

Students reflecting on practice to consider how skills might be changed, extended or improved.

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

15. Type a code to describe how often a TYPICAL STUDENT does this:

Students engaged in activities not covered in Q8–Q14. Please also specify the activity [ ]

ON SCREEN? [ ] OFF SCREEN? [ ]

Codes: 0=never;1=seldom;2=sometimes;3=often;4=very often;5=always

---

16. From your experience with online delivery, please describe a recent teaching/ learning EVENT that you consider contributed to quality learning outcomes for your students. [ ]

---

17. Describe the USE of a learning tool (for example, multimedia, simulations, hypertext) that in your judgment has contributed significantly to quality learning outcomes for your students. [ ]

END OF TEMPLATE

••••••

Survey questionnaire for module coordinators

Survey to COORDINATORS OR MANAGERS offering VET modules online:

Evaluation of web-based flexible learning

Our email address is: c.mckavanagh@mailbox.gu.edu.au

****

This survey aims primarily at describing VET flexible learning modules CURRENTLY offered online. (see Q4 below for a definition of the scope). A fuller description of the project is in a separate email. The information will be used to improve web-based flexible learning. A final report of the project is expected before the end of 1999. We are also interested in noting modules, which you plan to offer in 1999. Please list these modules at the end of this survey. This survey is designed for email; however, if another format is more convenient for you please make use of it.

****

1. Name of institution [ ]
2. Contact person: [ ]

   Telephone: [( )]

   Email: [ ]
3. Type of provider: Public (TAFE) [ ] Private [ ] Other (please specify) [ ]
4. To be in SCOPE for this project a module must have ALL of the following characteristics:
   - have students enrolled in Australia at some time during 1998
   - use networked computers for delivery, access to resources, communication or assessment
   - offer flexibility as to time, place, mode or content of study
   - be in the area of vocational education and training (VET)
   - Do you offer modules that are within the scope of this project? [ ]

If your answer to Q4 is NO, then JUMP to the end to tell us about any plans for 1999 and then return this survey to us so we know NOT TO HARASS YOU.

****

We would like information from you about modules within scope. We will interpret your reply to this section as giving us permission to include your data in our reports. You may also wish us to seek formal permission from senior staff in your institution. If so please provide an address so we can send a letter of invitation.

Name of Senior Staff Member: [ ]

Position of Senior Staff Member: [ ]

Email address of Senior Staff Member: [ ]

****

For EACH MODULE IN SCOPE, please provide details as below: (make more copies of the template as needed)

Code [ ] Title [ ]

A staff member we can contact to ask about teaching strategies etc:

Name [ ] Email Address [ ]

Code [ ] Title [ ]

A staff member we can contact to ask about teaching strategies etc:

Name [ ] Email Address [ ]

Code [ ] Title [ ]

A staff member we can contact to ask about teaching strategies etc:

Name [ ] Email Address [ ]

A copy of the questions we want to ask of these staff members is in a separate email for your information.

****

Please list the code and title of additional VET modules that your institution will offer online in 1999.

Code[ ] Title[ ]

****

Appendix B: Project brochure

EVALUATION OF WEB-BASED FLEXIBLE LEARNING

A national project funded by ANTA through the National Centre for Vocational Education Research

Our email address is: c.mckavanagh@mailbox.gu.edu.au

This project aims at the key priority area of improving the quality and provision of flexible learning options in the vocational education and training (VET) sector. Web-based learning is increasingly becoming a key mode for flexible learning. Computer technology has added a new dimension by offering more flexibility to learners in the vocational education and training sector.

The aim of this project is to contribute to the National Research and Evaluation Strategy goal of improving Australia's vocational education and training system by developing and testing a comprehensive framework for the evaluation of web-based flexible learning. This evaluation framework will be tested with a sample of established web-based VET providers across Australia. The outcomes of this study will offer guidelines for the development of web-based learning materials and inform future policy directions, thereby enhancing the pedagogical dimensions of web-based vocational education and training.

The objectives of this project are to:

- Select a comprehensive framework and tools for the evaluation of web-based flexible delivery in the VET sector.
- Identify and evaluate in terms of the framework, selected offering in web-based flexible learning in the VET sector.
- Explore implications for educational practice and policy and propose recommendations to enhance web-based flexible learning practices in the VET sector.

The 'VET Sector' and 'web-based flexible learning' are defined below:

VET Sector is defined by the National Centre for Vocational Education Research (NCVER) in their National Research and Evaluation Strategy. NCVER interpret VET as:

> *... all the educational and training experiences that provide individuals with the competencies required in employment. Such experiences are offered by public VET providers (e.g. TAFE institutes), registered private VET providers, selected high schools and some universities.*

For the purposes of this project Web-based Flexible Learning is defined as:

- learning experiences, offered by a VET provider, which involves
- substantial use of networked computers by learners and which offers
- flexibility in terms of time, place, mode or content of study.

Project Method

The project team will collect data to address the objectives by:

- conducting a survey with a sample of staff from institutions (public and private) that provide web-based flexible learning options in vocational education and training; and
- conducting case studies with a sub-sample of staff and students from these institutions.

Please contact any of the members of the project team to share your views, experiences or to seek further information.

The Project Team

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Glossary

CD-ROM	Small optical disc that stores data in digital format (Falk & Carlson 1995)
'Conversational' interactions	One of the paired exchanges that occurs between and within learners and teachers, including exchanges involving ideas and actions and transformations between these (see figure 3)
Course requirements	The explicit and implicit specifications that students receive about what they are required to learn and do in order to gain credit for study
Curriculum flexibility	The capacity for a curriculum (both explicit and implicit) to respond rapidly and efficiently to the changing requirements of students, teachers/ trainers, managers, policy-makers and other VET clients
Database	File of information that users may access or change as part of a larger project or program (Falk & Carlson 1995)
Discursive	Describes a medium that supports discussion between students, or between student and teacher. Each interlocutor should be able to articulate a view, re-articulate in the light of the other's utterance, ask and reply to questions, though not necessarily synchronously. Thus letter-writing is discursive, whereas lecturing is not (Laurillard 1993)
e-mail	Electronic mail delivered and received over a digital network such as the internet. Software creates, transmits, and interprets the data streams (Brooks 1997)
Evaluation	Refers to ways of testing the quality or value of something in the educational context, usually course materials, or teaching methods, but sometimes also students. However, evaluation of students is more usefully referred to as 'assessment'. Evaluation methods for course materials include, for example, pre- and post-testing of students' knowledge, observation, interviewing (Laurillard 1993)
Flexible delivery	Flexible delivery provides a range of approaches for vocational education and training employers and learners with information they want, when they want it, at a convenient location and using a variety of approaches and resources. In other words, there is flexibility of choice for learning for employees and employers (ANTA 1999)
Formative evaluation	Contrasts with 'summative evaluation'. Describes the evaluation of course materials that provides information for improvement of those materials (Laurillard 1993)
Hypertext	Software programs that consist of networks of related text files (Falk & Carlson 1995)
Hypermedia	Software programs that consist of related text, graphics, audio files and video clips. These can be accessed through search strategies (Falk & Carlson 1995)
Instructional designer	Participant in the multimedia production team who designs the instructional goals, strategies, and content flow of an interactive multimedia program (based on learner analysis and identified objectives) (Falk & Carlson 1995)
Interactive	Used to differentiate computer-based learning from other methods by virtue of the computer's capability to be programmed to change its behaviour according to the learner's input (Laurillard 1993)
Interactive multimedia	Computer program that combines text, graphics, video, audio, and/or animation in a way that involves learner response (Falk & Carlson 1995)

Interactivity	Program that takes the user's actions into account and responds accordingly (Falk & Carlson 1995)
Internet	A dynamic electronic network that permits computers connected anywhere on the network to exchange information. The internet is essentially a worldwide network (Brooks 1997)
Intranet	A network that uses the same software as used on the Internet but that has controlled access—often physically constrained to the wiring within an organisation. A barrier allows some information to cross to the outside world, but much information exchange is confined exclusively within the organisation (Brooks 1997)
Learning style	Personal affective, cognitive, and environmental adaptations that influence the learning process (Falk & Carlson 1995)
Multimedia learning tool	A multimedia application that involves the learner(s) at a workstation using the instructional program in a self-directed manner (Falk & Carlson 1995)
Listserver (or listserve)	An automatic mailing system such that, when someone sends mail to the listserver, a copy is transmitted to all subscribers to that listserver
Microworld	A computer program that embodies rules governing the behaviour of defined objects and their interaction with each other, thus evoking the impression of a 'a little world' in which the user can manipulate the objects to build something in that world, via a language understood by the program (Laurillard 1993)
Multimedia	Systems that integrate video, text, graphics, and audio, often through combining a computer with an optical technology unit (Falk & Carlson 1995)
Offline learning	The learner not working with a computer or with a stand-alone computer that is not connected to a server and the internet
Off-screen	The learner not working from a computer monitor or keyboard
Online learning	The learner working with computer that is connected to a server and the internet
On-screen	The learner in front of a computer and interacting through the monitor, keyboard and other peripheral devices
Reflective	Refers to those teaching methods or learning activities that encourage the student to reflect on what they know, or on what they have experienced (Laurillard 1993)
Summative evaluation	Contrasts with 'formative evaluation'. Describes the evaluation of course materials that provides information on the success or otherwise of the implementation of those materials, possibly in comparison with alternative teaching methods (Laurillard 1993)
Teleconferencing	Communication over telephone lines or satellite broadcasting that combines voice with still frames or motion video (Falk & Carlson 1995)
Web-based flexible learning	Khan (1997, p.6) defines web-based instruction as '... a hypermedia-based instructional program which utilises the attributes and resources of the world wide web to create a meaningful learning environment where learning is fostered and supported'. For the purpose of this project web-based flexible learning is defined as learning experiences, offered by a vocational education and training provider, which involve substantial use of networked computers by learners and which offers flexibility in terms of time, place, mode or content of study